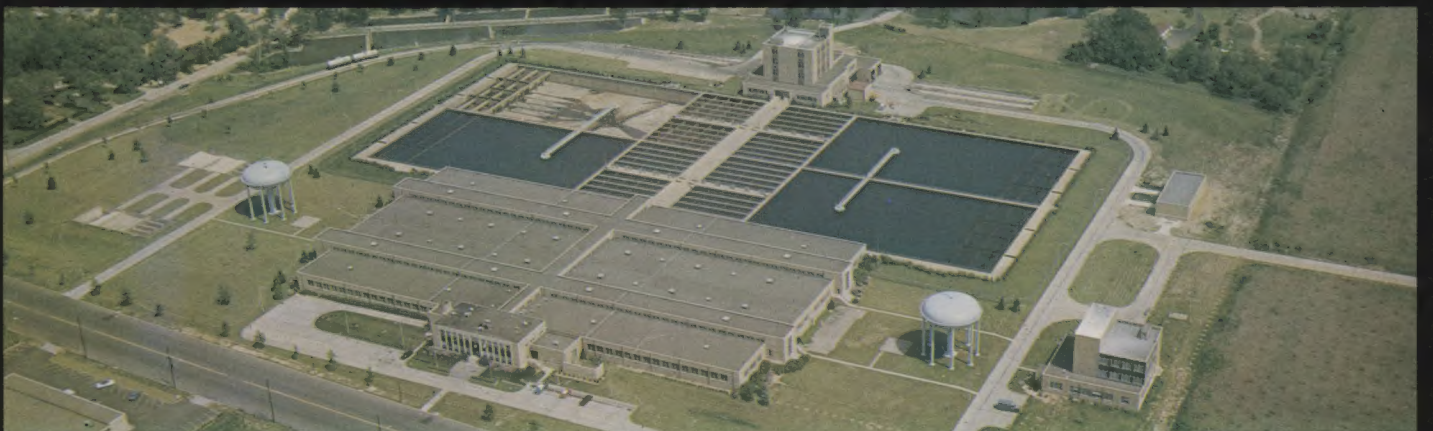


WATER FOR TOMORROW

Looking Ahead with the
Philadelphia Water Department

1973-75





FRONT COVER PHOTOGRAPHS

Top: An old print of the Fairmount Water works, 1853. Paddle wheels operated force pumps to supply city reservoirs with water.

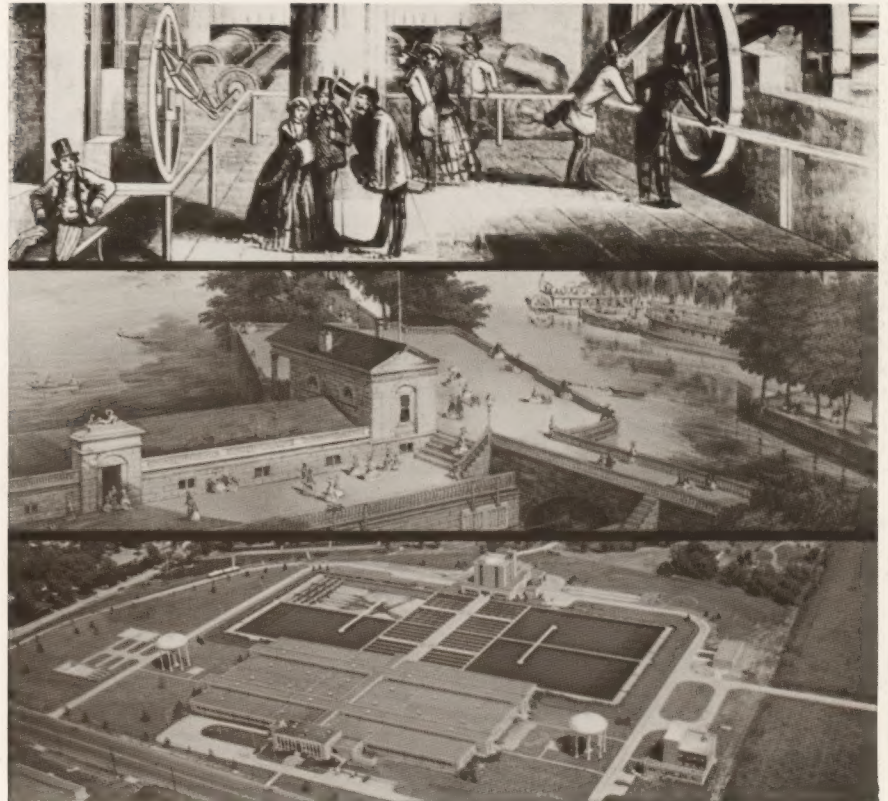
Middle: A fine chromolithograph of the Fairmount Water Works, mid-19th century. This forms part of the unique Frederick Graff Collection held by Franklin Institute. Reprinted, courtesy of Franklin Institute.

Bottom: The modern Torresdale Water Treatment Plant supplies half of the city with purified water.

Water for Tomorrow

A Biennial Report of the Philadelphia Water Department

- For the Two Fiscal Years from
July 1, 1973 to June 30, 1975
- With Significant Developments
Updated to December 31, 1975



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Mayor

Hillel S. Levinson
Managing Director

Carmen F. Guarino
Water Commissioner

CARMEN F. GUARINO
Commissioner

WATER OPERATIONS

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Deputy Commissioner
Water Operations

Division Chiefs

VICTOR A. PAGNOTTO
Chief
Water Operations

RICHARD SUPPLEE

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Water Treatment

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Water Main Records

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Water Operations Services

JAMES A. KENNY

Customer Service

HENRY HORNE

Automotive Maintenance

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Plant and Building

Maintenance

EDWARD MILBURN

Central Stores

ENGINEERING

KENNETH J. ZITOMER
Deputy Commissioner
Engineering

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Materials Testing

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Administrative Services Director

Assistants

FLOYD PLATTON

Personnel Officer

JACOB BALK

Meter Shop

JOSEPH A. DUFFY

Management Studies

JOHN T. CAPPJO

Safety Officer

FISCAL SERVICES

JOHN BRIGGS

Director

LEIGH B. HEBB

Chief

WATER POLLUTION CONTROL

MICHAEL D. NELSON
Chief

WILLIAM ROSS

Assistant Chief

Division Chiefs

GEORGE W. CARPENTER**

WILLIAM WANKOFF***

Wastewater Treatment

and Interceptors

THOMAS KULESZA

Industrial Wastes

RICHARD S. STARR†

Sewer Collector System

WALTER YOKA

Sewer Maintenance

FAULKNER EDMONDS

Drainage Information

COMMISSIONER'S STAFF

SAMUEL J. SCHWARTZ††

Assistant

RAYMOND J. HARRIS

Administrative Assistant

ROBERT F. WALKER

Executive Assistant

JOSEPH V. RADZIUL

Chief

Research and Development

*Sub Chiefs: Edward Shervin, Torredale Plant; Karl Kyriss, Belmont Plant; Bruce Aptowicz, Queen Lane Plant; and Water Quality Control and Research, Charles I. Pierce (Schuylkill).

**Retired January 21, 1975. Succeeded by William Wankoff.

***Sub Chiefs: Richard Di Menna, Northeast Plant; Charles Norkis, Southeast Plant; Robert Sharpe, Southwest Plant; Stanley Cywinski, Maintenance; William Barnes, Interceptors; and Frank Ferrara, Electrical Service.

†Resigned January 20, 1975.

††Retired February 13, 1976.

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Our Goal for Tomorrow is— Still Finer Water for our Customers

A salient fact about the Water Department today is the important planning which it is doing. This planning will assure pure, palatable, and abundant water for Philadelphians in future years.

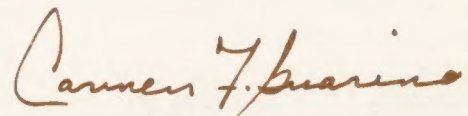
By the early 1980's, indeed, the department's technology will advance far beyond the impressive know-how of today. It will be able to remove tiny, invisible trace organics from water, along with the subtle tastes and odors sometimes associated with these.

Water will be treated and delivered by computer. New wastewater plants and computerized electronics will protect the rivers. Sophisticated laboratory controls—beyond imagination at present—will watch over water quality.

This report describes the progress that the department is making towards these and other goals. It also outlines some problems, such as the uncertain future of the sorely needed Tocks Island Dam.

The department is moving through a difficult time when nationwide inflation and environmental pressures are posing unusual challenges.

We shall not cease, however, to look to the future needs of our customers. Though today Philadelphia's drinking water is one of America's purest and safest, it will be even better, we believe, tomorrow.



CARMEN F. GUARINO
Commissioner



Our Historic Past

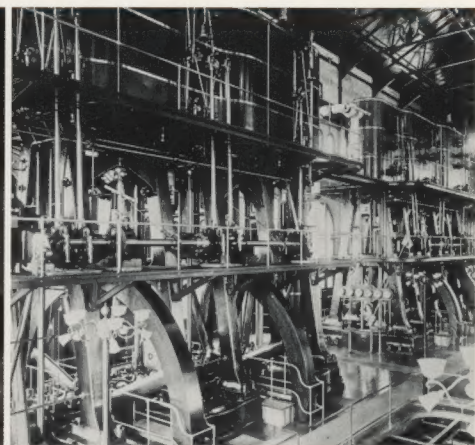
175 YEARS OF WATER SERVICE



The first use in America of steam pumps for large scale water supply began in Philadelphia in 1801. A Schuylkill River station (above) pumped water to a station at Centre Square (below). This early system was the work of Benjamin Henry Latrobe.

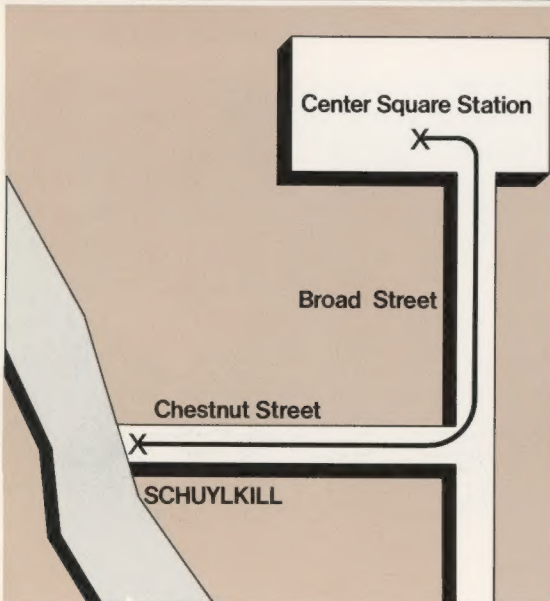
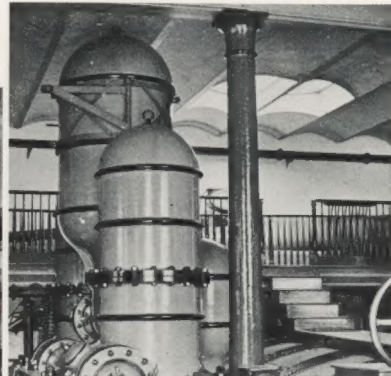


Guiding spirit of Philadelphia's early water system was Frederick Graff, Sr., who was superintendent from 1805 to 1847.



Above: Three-storey high steam pumps at the Lardner's Point Pumping Station in 1908.

Below: Pumps and expansion tanks for water turbines at the Fairmount Works in 1876.



The Spring Garden Works (1844) served at first a district outside the city proper, but was later incorporated into the city. The Spring Garden standpipe (or water tank) is shown in the 1890's.



Philadelphia built its first filtration plants (slow sand) between 1901 and 1911. These together with chlorination wiped out water-borne diseases. Photo, old Torresdale Plant.

Highlights

On January 27, 1976, Philadelphia's water system was 175 years old. This system—almost the first public water system in America—was only a quarter century younger than the nation itself.

It had been the first water system in America to use steam powered pumps for large scale service—the first to adopt water wheels and water turbines—the first to build the biggest slow sand filter plants in the world.

And in mid-20th century, it was one of the first to apply push-button and microwave controls to newly constructed treatment plants, pumping stations, and reservoirs.

By the 1950's, indeed, progress in water supply had become a consuming goal of the city.

In pursuit of this goal, Philadelphians spent \$217 million for the modernization of their water system (1946-75), and another \$391 million on a network of sewage facilities to protect and clean up the rivers.

Thanks to these improvements, the city's finished water had become one of the purest in the nation. It met or surpassed all of the 41 national quality standards established by the Federal Government.

Water Service

As 1976 opened, however, the Water Department chose not to look back. It was looking ahead to the 1980's—and to further improvements in streams, drinking water, and customer service.

There were urgent reasons for the department's policy.

For five years past—as news reports mounted—the nation had worried about the purity and safety of its water supplies. There were reports of growing stream pollution, industrial chemical spills, and invisible trace organics in drinking water.

Though some reports were tinted or overblown, the Water Department welcomed the growing public interest. For several years, it had been preparing ambitious plans to refine and upgrade its water further.

1. Not the least of these plans called for an all out attack on the infinitely tiny organics which had shown up in streams and water supplies. In 1975, the department became the first water utility in the country to—

- Complete (jointly with Drexel University) a three-year study which discovered profiles, or "fingerprints", for the hard-to-detect organics and developed electronic instruments to identify them,

- Find and report on trace organics in its own drinking water,

- Award a contract for a pilot plant to determine the best methods for removing trace organics from water.

Although there is presently no conclusive scientific evidence that the infinitesimal concentrations of organics in Philadelphia's finished water are harmful to human health, it is likely that the Federal Government will require the removal or reduction of some organics by all communities in the next few years.

2. To improve water quality, Philadelphia will become the first city in the world to control the treatment and distribution of water by computer. In 1975, consultants submitted a \$43 million plan and final report on the automation of water treatment plants, pumping stations, reservoirs, and microwave facilities. This five-year plan will also reduce operating costs.

3. To protect drinking water from taste-and-odor causing algae, the Water Department began to cover its open reservoirs. In mid-1975 it placed a \$770,000 floating cover on the north basin of the Oak Lane Reservoir. The south basin will be covered in 1976.

4. Chlorinous tastes and odors became a thing of the past in the spring of 1975 as Philadelphia began to treat



For Treatment: New lime towers rise at the Belmont Water Plant. These will blow pebble lime to storage tanks. A \$414 Million Expansion: To improve its rivers, the city began construction of new facilities at its wastewater plants. Mayor Frank L. Rizzo breaks ground at the Southwest Plant and a contractor lays effluent piping.

all of its water with ammonia. The ammonia combined with chlorine to form an odorless, tasteless, longer lasting disinfectant.

5. Philadelphia also became the first American city to acquire a mobile laboratory to keep watch on water flowing through its pipelines. The laboratory, equipped with electronic monitors, will do daily water analyses in all parts of the city.

6. While upgrading water, the department made other changes in the water system. It—

- Replaced an old gate house and valves, at a cost of \$1.25 million, at the Belmont Treatment Plant, thus improving control over water flow,

- Installed new systems for the handling and application of lime at the Torresdale and Belmont Treatment Plants,

- Laid 34 miles of new water mains in all parts of the city, from July 1, 1973 to December 31, 1975.

The value of all water system facilities built in this period totaled \$8.1 million.

Stream Clean-up

Greater stream protection was another goal of the city. This was intended to benefit water supply, shipping, boating and fishing.

To improve the Delaware and Schuylkill Rivers by the 1980's, the Water Department was planning to expand its "water pollution control" plants. These plants treat wastewater (sewage) from the city and neighboring communities.

At an expansion cost of \$414 million, the new plants will discharge a cleaner effluent to the Delaware River estuary.

Construction of the new facilities began on October 10, 1975, when Mayor Frank L. Rizzo broke the first ground at the Southwest Plant. By December 31, the city had awarded or was processing \$99 million of contracts for

two of its three plants.

Scheduled to be completed in the period 1979-81, the new plants will remove over 92% of pollution from wastewater, as measured by biochemical oxygen demand. This compares with 50% to 55% at present.

In addition, the plants will have many operating refinements, including automation. At every treatment stage, information will flow to computers, and these will send "orders" to plant equipment.

Philadelphia will also provide a more truly regional service. With enlarged capacities, the new plants will receive and treat larger wastewater flows from outlying communities, including fresh service areas. This will increase the protection of streams at a time when wastes from communities and industries are growing in the Delaware River Basin.

From July 1, 1973 to December 31, 1975, the Water Department invested \$29.8 million in improvements to the wastewater system. Thus it—

- Constructed pollution-free incinerators at the Southeast and Southwest Water Pollution Control Plants to burn grease and oil skimmed from wastewater (\$1,847,750),

- Began construction of a giant tunnel sewer in Nedom Avenue to prevent storm flooding in portions of North Philadelphia (\$5,026,000),

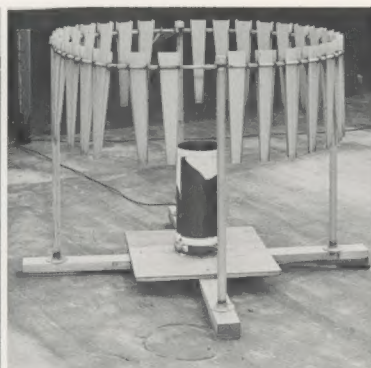
- Laid 23 miles of sanitary and storm sewers in all parts of the city,

- Built a waterway opening under Mingo Avenue as a first step toward construction of a huge surge basin to receive back up waters from Mingo Creek during storms,

- Installed a small computer at the Northeast Water Pollution Control Plant to control storm overflow by combined sewers into streams. Eventually, 180 regulating chambers and 48 rain gauges will be linked to this computer.



Computerizing Storm Overflow: To reduce future pollution of streams by storm sewers, the Water Department began to link 180 regulating chambers and 48 rain gauges to a new computer at the Northeast Plant.



New Rain Gauge: To automate the collection of rain data, the department began to replace its 48 rain gauges with tipping bucket gauges.



Cooling Showers: Children were receptive to Philadelphia's new Summer Showers Program. The Water Department distributed 2,500 free spray caps each summer through neighborhood police stations.

To protect water quality, Philadelphia monitored the rivers continuously. Its fixed monitoring stations sent stream data to a U.S. Government space satellite, and the satellite in turn relayed the data via ground station to a teletype receiver in the Water Department.

In August, 1975, the department's laboratory boat joined boats from other public agencies to do an intensive two-weeks' study of the Delaware estuary.

The department was also looking closely at the sources of stream pollution. It studied storm water overflow, urban runoff, and industrial sources of heavy metals and toxic wastes.

Because of rising flows, the water pollution control plants were producing more digested sludge. With no place to put this sludge, the city was barging most of it to the Atlantic Ocean.

Although studies showed that the sludge was not harming oceanic life, the Environmental Protection Agency ordered Philadelphia to cut ocean disposal in half by 1979 and to end it by 1981.

The Water Department had already begun a search for other disposal methods. It was planning multi-million dollar studies of land disposal and the Puretec "wet oxidation" process.

Other Developments

While improving streams and drinking water, water officials were concerned about rising costs. To reduce the burden on the public, they were making many savings.

The department, in fact, had cut personnel overtime by 20% since 1971. A manpower study had also brought improved procedures and more efficient use of personnel. As a result, the accumulated savings exceeded \$6 million.

Personnel had been steadily whittled in the last few years, and, despite new or expanded functions, the department had achieved a net reduction of 151 perma-

nent, full-time employees since 1958.

To streamline procedures, management was turning increasingly to a digital computer for engineering and administrative studies. Use of the computer soared to nearly 2,400 hours in 1975, and in October of that year it was replaced with a later, faster and more capacious model.

To improve employee performance, the department provided a variety of training. This included executive seminars and courses at colleges and industries. Thirty-seven graduate engineers were hired at Eastern colleges to meet pressing needs.

As a result of these and other improvements, Philadelphia residents had escaped the rising costs of water-sewer service. By December 31, 1975, five and one-half years had passed without an increase in the water-sewer rates paid by homes, businesses, and industries.

Unhappily, this record cannot be maintained in 1976. Inflation, stream clean-up, and federal requirements will force an increase in the non-charity rates.

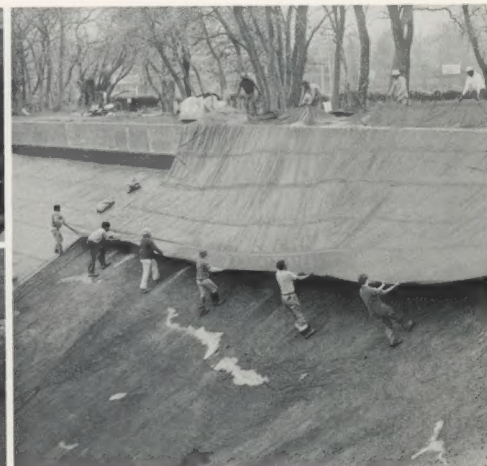
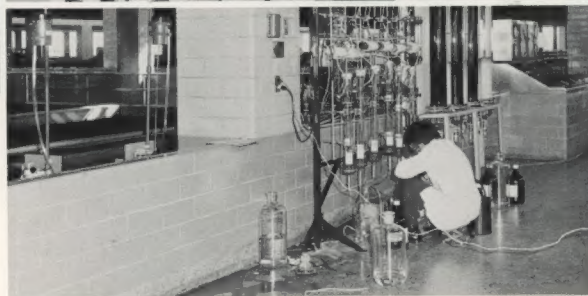
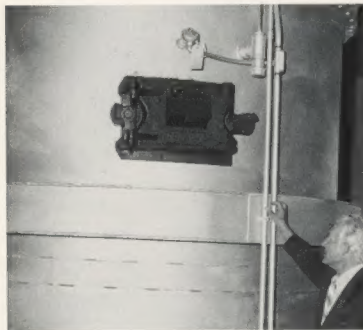
Some "charity" rates were raised on July 1, 1974. These were those paid by colleges, universities, hospitals, and the Philadelphia Housing Authority.

For low-income, senior citizens, however, there was a reduction of 20% in the "minimum" charge for water and sewer service, effective January 1, 1974. This resulted from an ordinance approved by the Mayor and Council.

While reducing costs, the Water Department served the public in many ways. It—

- Responded daily to hundreds of customer emergencies,
- Issued a manual of rules and regulations governing water and sewer service,
- Provided fire hydrant showers—and free spray attachments—for children every summer.

Sympathetic attention to customer needs was a guiding policy.



No More Odors: Smelly grease and oil skimmed from wastewater will be destroyed in new pollution-free incinerators at the Southeast and Southwest Plants.

For Better Water: In the hope of removing infinitely tiny organics from drinking water, the Water Department and Drexel University were doing advanced studies. These included detection (top) with a gas chromatograph and trial filtration (bottom).

Floating Cover: Workmen place a large floating cover of hypalon membrane on a basin at Oak Lane Reservoir. The Water Department plans to cover all of its open reservoirs to protect water quality.

FACTS IN BRIEF

	Fiscal 1974-75 ¹	Fiscal 1973-74 ¹	Calendar 1965
Population.....	1,948,609 ²	1,948,609 ²	2,002,572 ³

WATER SYSTEM:

Consumption of filtered water			
• Per person on average day (gals.)	183.3 ⁴	187 ⁴	162.8 ⁴
• Average day (million gals.)	364.2 ⁵	368.4 ⁵	326 ⁴
• Total annual (billion gals.)	132.9 ⁵	134.5 ⁵	118.9 ⁴
• Maximum day (million gals.)	550 ⁶	540.1 ⁷	455.2
Facilities at end of year			
• Fire hydrants.....	25,610	25,569	24,740
• Valves.....	78,536	78,031	72,850
• Water mains (miles)	3,249	3,242.4	3,176.2
Accounts at end of year			
• Meters in system.....	521,051	521,040	526,632
• Unmetered accounts	3,821	3,891	1,741
• Total services	524,872	524,931	528,373

WASTEWATER SYSTEM:

Wastewater treated on average day (million gals.)	463.8	463.7	386.3
Total wastewater treated in year (billion gals.)	169.3	169.2	141
Sewers at end of year (miles).....	2,878.7 ⁸	2,873.3 ⁸	2,787.4 ⁹

HIGH PRESSURE FIRE SYSTEM:

Facilities at end of year			
• Fire hydrants.....	1,069	1,070	1,050
• Valves.....	1,930	1,930	1,868
• Water mains (miles)	64.5	64.5	63.3

Miles of Pipelines Built

	Water Mains	Sewers
January 1, 1953 to June 30, 1973.....	689.79	669.41
July 1, 1973 to June 30, 1974	12.8	8.6
July 1, 1974 to June 30, 1975	11.61	7.18
July 1, 1975 to December 31, 1975.....	10.0	6.75

- Notes: 1. July 1 to June 30 fiscal year
2. U.S. Census figure for 1970
3. U.S. Census figure for 1960
4. Philadelphia only
5. Water delivered to City and Bucks County
6. Tuesday, July 9, 1974—temperature 95 degrees F.
7. Thursday, August 30, 1973—temperature 98 degrees F.
8. Based on new Sewer Inventory
9. Figure retroactively adjusted to reflect new Sewer Inventory.

Water System

Trace Organics: A City Meets the Challenge

After 23 years of construction, the water system was largely modern. It had adequate capacity, and it was producing palatable water of highest purity.

Yet despite past progress, the Water Department had new plans for upgrading this system. It planned to enlarge capacity, increase efficiency, and improve water quality further.

Perhaps, the most pressing of these goals was a further improvement of the city's drinking water.

Although Philadelphia's drinking water met all national quality standards, the city faced a new challenge in 1974. The Environmental Protection Agency suggested a possible link between trace organics—those tiny invisible compounds found in many of the nation's water supplies—and cancer.

Although this link had not been proved, the EPA began to examine the water supplies of 80 cities. It also sought to determine, with the aid of the National Cancer Institute, whether some organics in water were toxic.

These organics were of natural as well as industrial origin, and some, it was thought, resulted from the combination of chlorine at treatment plants with the river-borne substances.

Fortunately—well before EPA and the rest of the country—the Water Department had begun its own study. Jointly with Drexel University, it had developed new automated methods for detecting organic compounds in raw and finished water. This three-year old study, initiated in 1971, had provided profiles (or “fingerprints”) for a variety of organics, and created new electronic devices to use the profiles to find the organics.

Using the new methods in combination with a computer, the Water Department and Drexel University

identified 18 organic compounds in the finished water of the Torresdale Treatment Plant in June, 1975. Philadelphia thus became the first city in the country to identify its own trace organics.

In the same spring—as a result of its national survey—EPA reported 36 organics in the Torresdale finished water, but some of these may have been transient. EPA also fixed national “guidelines” (or permitted maximum concentrations) for six organic compounds found in the nation's water supplies. These six compounds were considered suspected carcinogens.

Happily, the Torresdale finished water contained only one organic which exceeded an EPA guideline. This organic (Bis-2 chloroethyl ether) occurred in concentrations of only four-tenths to five-tenths (0.4 to 0.5) of a part per billion.

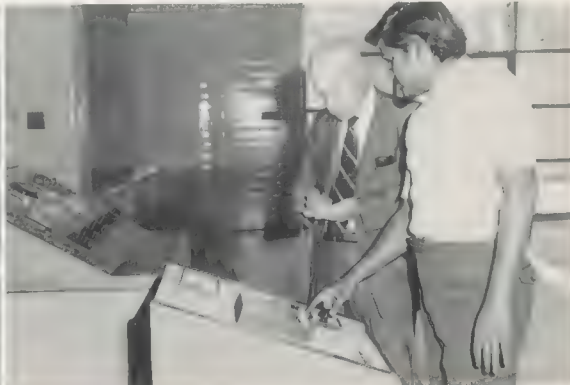
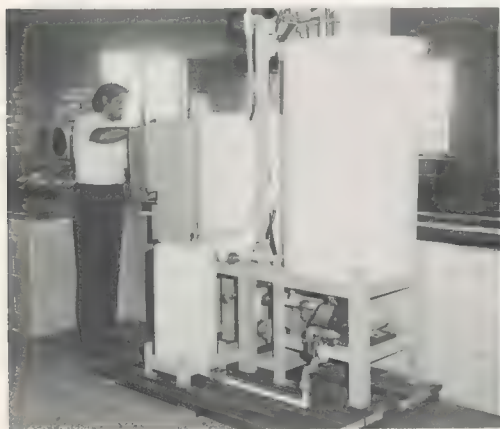
There was no scientific evidence that this infinitesimal concentration was harmful to human health. Nevertheless, the Water Department moved at once to reduce it. Torresdale water was treated with increased quantities of activated carbon, and the department successfully located and stopped the indirect discharge of Bis-2 to the river by a local industry.

At the beginning of 1976, the department and Drexel University were extending their study of trace organics to include the effluents of the city's other two water plants.

A Pilot Plant to Remove Water-Borne Organics

In its fight against trace organics, Philadelphia achieved another “first” in 1975. It became the first American city to announce plans for a pilot plant to develop the “best methods” for removing trace organics from drinking water.

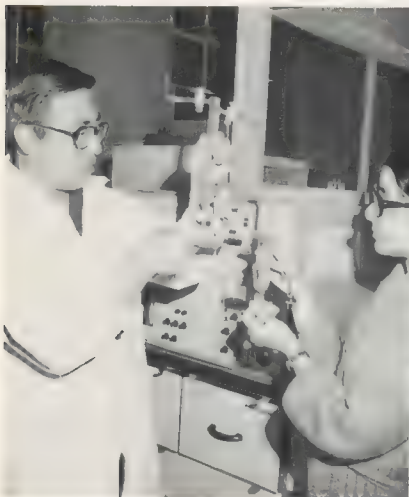
During the year, the city awarded a \$285,000 contract to Mark III Mechanical, Inc., for the fabrication and installation of equipment.



High Rate Filters: In the hope of filtering water faster, engineers began a study of two new types of filter beds at the Queen Lane Plant. Each bed contains anthracite and sand. An engineer (photo) checks equipment for adding a coagulant to water entering a Turbitrol filter.

High Rate Study: Equipment for adding coagulant chemicals and recording flow rates, etc., is inspected at the site of a Neptune microfloc filter. If high rate filters prove successful, all filter beds at Queen Lane will be converted to high rate filtration.

Our city will remove tiny organics from water



Meeting a Challenge: To find and remove organics, the Water Department and Drexel University are working out new and imaginative methods. Drexel employees hold part of new apparatus to separate less volatile organics from water.



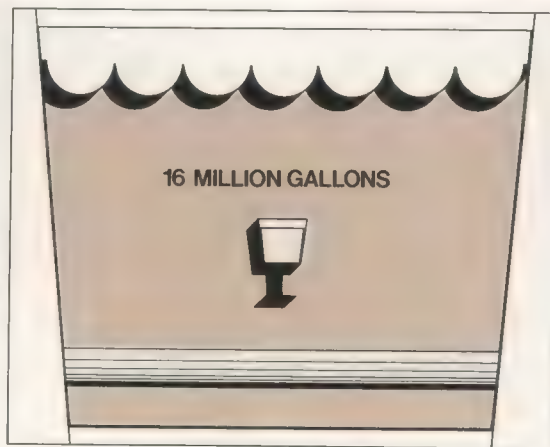
Pilot Plant: Three tall adsorption columns will form part of a small pilot plant that will go into operation at the Torresdale Water Plant in 1976. The pilot unit will be used to determine the best methods for removing trace organics from water.



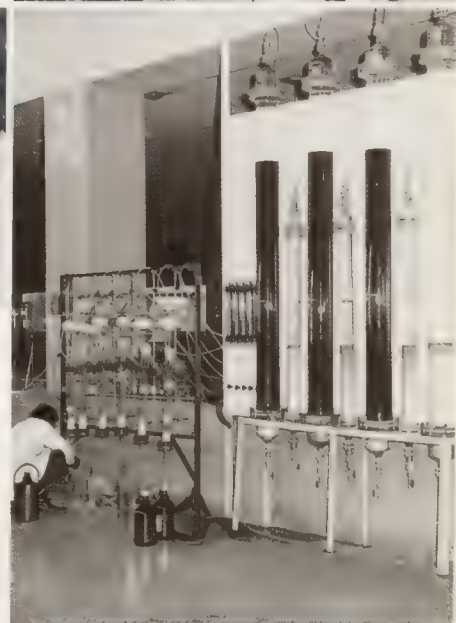
New Laboratory: A \$500,000 laboratory which will specialize in the study of trace organics takes shape at Torresdale.



Electronic Detective: This gas chromatograph at a Water Department laboratory is used to measure "head gases" given off by some trace organics.



Tiny Organics: Trace organics are infinitely tiny . . . occurring in parts per billion or less in the nation's water supplies. One part per billion is like a water glass compared with a 16-million gallon reservoir.



Pre-study: Preparing for pilot plant study, engineers use special apparatus to note the effect of activated carbons and resins on water. Columns filter out organics for further testing.

The miniature pilot unit, which will be set up in the Torresdale filter building, will duplicate on a small scale all of the conventional, and some non-conventional, treatment processes. It will be used to find the most effective, yet economical, combination of these methods.

Conventional treatment to be tested will include systems for applying chlorine, ammonia, ferric chloride, alum, chlorine dioxide, and lime to drinking water. Non-conventional treatment will include the use of carbon filters of the gravity and upflow types, coagulation with magnesium carbonates, the application of ozone and polyelectrolytes, and the use of macroreticular resins.

The pilot unit will also be used to study—

- Removal of tastes and odors caused by organics, and
- Automation techniques, in preparation for the future computer control of the city's water system.

There is need for this study because—

- Conventional treatment is unable to cope effectively with some of the tiny organics in water,
- Too little is known by the water works industry about effective removal techniques for trace organics,
- EPA is expected to issue additional guidelines that will severely limit the permissible concentrations of some organics in drinking water,
- Ultimate removal of trace organics will cost Philadelphia millions of dollars for new capital equipment and plant modifications.

The miniature pilot plant will include a clarifier basin, two gravity filter tanks with automatic backwashing, three tall adsorption columns, and a variety of gas storage cylinders, tanks, pyrex bottles, ozonators, chlorinators, pumps, piping, valves, meters, and control panels.

The study will take from one to three years.

As an aid to this and other studies, the department created a new type of research laboratory at the Torresdale Plant. The \$500,000 laboratory, which will be

opened in 1976, will specialize in the study of trace organics. Among its equipment will be an advanced computer—a gas chromatograph-mass spectrometer.

Steps Towards Automation

To improve drinking water, the department pressed ahead with plans for automation.

It was planning to install a master computer (or computers) to monitor and control water treatment plants, pumping stations, reservoirs, and the microwave network. Such automation of a water system had not yet been tried by any city.*

Under Philadelphia's plan, electronic sensing devices will be located throughout the water system and along the rivers. These will report to the computer on stream quality, chemical treatment, filtration, water flows, finished water purity, and other conditions. The computer in turn will analyze this data, and then issue "orders" to a variety of control equipment.

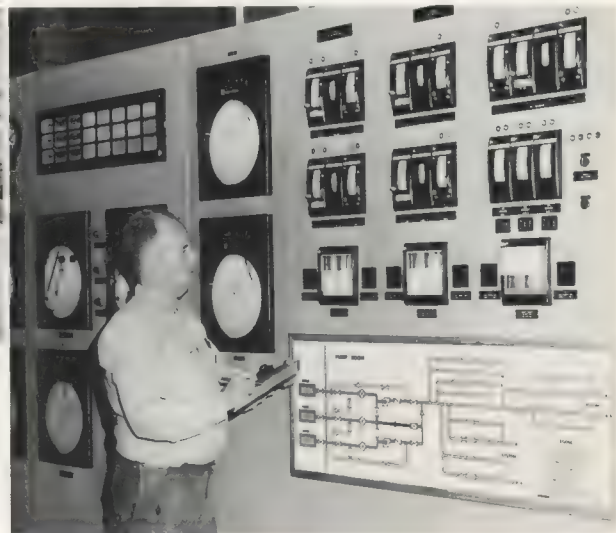
This plan will bring many benefits. It will hold down chemical and manpower costs, provide more precise control of water treatment, and produce better finished water.

In 1973, a group of private consultants began to study the city's plan. By the end of 1975, they had nearly completed a final report.

Working under a \$606,000 contract, the consultants—

- Prepared a five-year automation plan for the treatment plants and distribution facilities,
- Surveyed existing plant equipment and recommended a schedule for the replacement of obsolete or worn equipment, and
- Designed plans and specifications for the initial automation of the Queen Lane Treatment Plant and for

*A few communities have used computers to log data on water flow, but none has used a computer to control the treatment and distribution of water independently of human operators.



New Gate House: To improve control of water flow from the raw water reservoir to the chemical building, an old gate house was replaced at the Belmont Plant. The \$1,190,000 job included installation of 15 large valves.

Ammonia Treatment: By the spring of 1975 all of the city's drinking water was being treated with ammonia to remove chlorinous tastes and odors. An operator above checks a control panel that forms part of a new ammoniation system at the Torresdale Plant.

construction of new chemical facilities at the East Park and Oak Lane Reservoirs.

The consultants also submitted a proposed capital program to cover design and construction through fiscal 1975-80. This included \$8 million for computers and instrumentation plus \$35 million for related changes in plants and reservoirs.

Such related changes at the Queen Lane Plant (which will be computerized first) will include construction of central computer and satellite control rooms, chemical distribution systems, a chlorine-fluoride building, tanks for carbon and lime, a chemical pipeway, a quality control laboratory, and a headquarters building. In addition, rapid sand filter beds would be converted (under the proposal) to high rate filtration.

A \$728,000 contract was awarded to Black, Crow, and Eidsness, consultants of Gainesville, Fla., to develop plans and specifications for most of these changes. Black, Crow and Eidsness also head the automation study.

Two Water Department committees worked closely with the consultants on automation planning. Much work was also done by the department on mathematical "models" to facilitate future computer "process control" of filtration, coagulation, and chemical dosages in the treatment plants.

For Better Water—Ammonia Treatment

The city's residents began to enjoy a still safer, better water on April 1, 1975. On that date the Water Department started to ammoniate the water treated by its Torresdale and Queen Lane Plants.

The ammonia, applied in minute, carefully controlled doses;

- Eliminated all chlorinous tastes and odors in the water issuing from the plants,
- Combined with chlorine to form an odorless, longer lasting disinfectant called chloramine, whose protective effects were felt by 1.6 million Philadelphians living between the Delaware and Schuylkill Rivers,
- Prevented detergent residues left on improperly rinsed drinking glasses from combining with chlorine to create bad tastes and odors.

The result was a more palatable water, more pleasing to many of the department's customers.

Ammonia-treated water was not new to some of the city's residents. Over 400,000 persons in West Philadelphia had received such water from the Belmont Plant since 1967. Extension of this improvement to the rest of the city had long been planned.

A \$259,900 ammoniation system, which included application and control units, chlorine residual analyzers, storage tanks, pumps and chambers, had been fully installed at the Torresdale Plant by June 1974. Also finished were minor modifications to a similar system at

the Queen Lane Plant. A shortage of ammonia supplies on the market, however, delayed inauguration of ammonia treatment at the two plants until the following year.

New Facilities for the Treatment Plants

To improve treatment efficiency, the department made a number of changes at its water plants. It also laid plans to enlarge filtration capacity.

These physical improvements were made under contracts totaling \$5.8 million. Approximately \$4.2 million of construction was performed from July 1, 1973 to December 31, 1975.

Control of Water Flow: As a result of this work, a new gate house was providing more flexible control of water flow at the Belmont Plant. The gate house, together with new valves and by-pass piping, regulated the passage of river water from the raw water basins to the main plant. The steel-and-concrete structure replaced a brick gate house dating from 1902.

As part of the \$1,190,000 job, the contractor installed a dozen 48-inch gate valves, three huge butterfly valves, five valve chambers, and eight sluice gates with operating mechanisms. The contract also included a distribution control panel, electrical equipment, and 900 feet of large steel pipe.

High Rate Filters: An important goal of water planners was to achieve faster filtration of water. This would increase output of purified water and reduce the frequency with which filter beds must be washed.

To attain this speed-up, the department planned to test two types of high-rate filters. One of these would be a Turbitrol filter, containing anthracite over sand; the other a Neptune microfloc, consisting of anthracite over ordinary sand, which in turn would overlies fine garnet sand. In 1975, installation of two such filter beds began at the Queen Lane Plant, under contracts totaling \$143,000.

Besides filtering water faster, anthracite (it is believed) will make it possible to add a coagulant chemical to water entering the filters. This chemical would improve water purification, and it could be removed by the anthracite.

The contracts also provide for automatic control systems for coagulants, sample pumps with controls, and filter aid mixing units. These will help to determine the proper chemical dosage to apply to water in the sedimentation basins, and whether raising or lowering this dosage in combination with the high-rate filters will raise or lower operating costs.

If the department's study proves successful, the remaining 38 filter beds at the Queen Lane Plant will be converted to high rate filtration. Present filter beds have a sand layer over gravel, and each purifies three million gallons a day.

Lime Treatment: The plants used over 20 million pounds of lime in fiscal 1975 to treat water. This lime was used to coagulate water impurities and to reduce corrosion of mains and household fixtures.

Because of this, the department sought to improve the unloading, storage, feeding, and slaking of lime.

Thus at the Torresdale Plant it installed a variety of lime handling equipment, including dust collectors and four feeders and slakers. This equipment quickly eliminated lime dust, prevented grit settlement in conduits, increased lime storage, and helped to improve the hydraulics of sedimentation basins.

Two additional feeders and slakers will be installed at the Torresdale Plant in 1976, and "pH" control will be automated. The contracts for new lime facilities completed or planned total \$215,191.

Pebble lime will replace hydrated lime at the Belmont Plant. Two tall towers for receiving the lime, and blowing it to an upper story of the chemical building, were installed under \$350,747 of contracts in 1975. A control panel and other equipment were awaiting installation.

Pebble lime, which is mixed with water to form a slurry, cakes less and flows more easily than hydrated lime. It can also be stored in less space.

Ferric Chloride Treatment: Construction of an all-automatic system to store and apply ferric chloride began at the Torresdale Plant. The \$71,500 job was almost finished at the close of 1975.

The new system recognizes the growing importance of ferric chloride as a coagulant at the plant. It also will make possible the direct purchase of ferric chloride from manufacturers. In the past, the plant produced much of its own ferric chloride by combining chlorine and ferrous chloride. Because of the rising price of market-short chlorine, this is no longer economical.

Dredging of Raw Water Basins: To increase settling capacity, two large river-water basins were cleaned by hydraulic dredge. The dredge removed 115,000 cubic yards of sediment from the basin of the Queen Lane Plant in mid-1974, at a cost of \$379,000.

At the riverside basin of the Torresdale Plant, 250,000 cubic yards were taken out in 1975 under a \$347,500 contract. Additional dredging will be done there in 1976. The Torresdale and Queen Lane basins hold 176 million gallons of water each.

Electronic Testing of Water Quality

Through its laboratories, the department kept close watch on the purity and safety of water.

Its personnel collected 140,000 water samples yearly. These came from the rivers and from all parts of the water system, including plants, reservoirs, and distribution pipelines.

On these samples the laboratories performed up to 1.5

million tests each year. These tests included both wet chemical and electronic instrumental analyses. On the average, two or three tests were performed every minute.

Tests were made for purity, taste, odor, clarity, and numerous organic and chemical constituents.

Although routine testing was done by the plant laboratories, the Water Quality Control and Research Unit made a number of special studies. It developed new or improved methods for extracting trace organics from water, analyzing chlorinated hydrocarbon pesticides, using macroreticular resins in research, testing of carbon, and identifying bis-2 chloroethyl ether. Water Quality Control personnel worked closely with other units in surveys of local streams.

To improve its control over the quality of water flowing through reservoirs and mains, the department took several steps:

1. In June, 1975, it put into service one of America's first laboratories on wheels. Purchased at a cost of \$25,510, this mobile van will monitor water in all parts of the city. It will tap into public mains or hook up to household plumbing.

The van will carry a variety of electronic instruments, capable of detecting and measuring numerous "parameters" (or conditions) of water. Twenty-seven feet long and eight feet wide, it is equipped with gas and air lines, miniature water "systems", sinks, closets, and other useful items.

The new laboratory was inspired by a prototype developed by the National Sanitation Foundation and displayed in Philadelphia in September, 1973.

2. Although laboratory personnel collected water samples throughout the city, the time that could be given to such collection totaled only a few hours daily.

To supplement manual sampling, the department created a small, automatic system to provide continuous monitoring of water at five locations. Sensing instruments at these locations analyzed drinking water for chlorine residual, "pH", and turbidity in 1975, and then relayed this data to the Microwave Center by land wire.

There were plans to acquire three more monitoring instruments in 1976, thus making it possible to cover the city more widely. The new monitors will be moved from place to place, remaining a few weeks at each location.

3. Because water sometimes picks up trace metals as it flows through mains and home plumbing, the department drew up plans for a comprehensive study of such pick-up. This study will help the city meet future limits which will be set by the Federal Government for trace metals.

The study, which will begin in 1976, will relate metals pick-up to such factors as dissolved oxygen, "pH", flow rate, calcium carbonate saturation, corrosion inhibitors, temperature, and type of home plumbing. Some of these

influence water corrosivity, which contributes to metals pick-up.

The new mobile laboratory will aid in this study.

Customer complaints reaching laboratory personnel were relatively few each year. In fiscal 1975, there were only 47 relating to tastes and odors and 19 to particles in water. Many of these problems were traced to home plumbing. There were some initial complaints about the start of ammonia treatment, because some pet fish owners had not learned how to neutralize the chloramine (formed by ammonia and chlorine) in the water.

The Reservoirs: New Floating Covers

In mid-1975 a gigantic floating cover was placed on the north basin of the Oak Lane Reservoir. This was part of a long range plan to cover all of the open reservoirs which hold purified water. For these and other reservoir improvements, the Water Department was planning to spend \$5 million from 1975 to 1982.

The purpose of covers will be to protect the purity of drinking water, prevent the growth of taste-and-odor causing algae in the summertime, and reduce the quantity of costly chemicals needed to treat reservoir water.

At Oak Lane, the contractor installed a floating roof of hypalon membrane (a synthetic rubber) reinforced with nylon. Attached to the upper periphery of the basin, the roof rose and fell with the water level.

The sides and bottom of the basin were lined with similar material, guaranteed to last for 20 years. The new roof and linings will be strongly resistant to weight, puncture, tearing, heat and cold.

The \$770,000 job also included the repair of deteriorated concrete surfaces, the spreading of 6,250 cubic yards of sand on the reservoir floor beneath the lining, and the installation of structural aluminum.

Although the new Oak Lane cover was to be tested for a year, it proved quickly successful in preserving water quality and minimizing costs. As a result, the department awarded a second contract in December, 1975, for covering the south basin of the reservoir. This \$902,000 job will be done in 1976.

The Oak Lane Reservoir supplies portions of North and Northeast Philadelphia. Each of its two basins holds 35 million gallons.

East Park Reservoir: Design engineers also began a study of the huge East Park Reservoir to determine its future uses, and the modifications that it will require. The study will include the feasibility of placing a floating cover on one or more of the three basins.

Spread over 100 acres, the reservoir stores 688 million gallons of water. This water is used to boost pressures, and to meet emergency needs, in central and southern parts of the city.

Although water quality was good at the Oak Lane

Reservoir, it was less satisfactory at East Park. This was because of different flow patterns, volumes, and chemical application points at the two reservoirs.

To improve the flow pattern in the south (commonly used) basin at East Park, a new \$60,000 gate chamber was built in 1975. This chamber included an outlet channel separate for the first time from the inlet channel, and a new steel circular screen. An inlet line to the center of the basin will be built in the future to turn over the water more frequently.

In 1974, a roadway which runs for 1.4 miles around the East Park Reservoir was widened and covered with cinders. The \$90,000 job included the landscaping of the outer embankment with fresh soil, trees and shrubs.

As noted before, new chemical control buildings will be erected at both the East Park and Oak Lane Reservoirs under the department's automation plan.

To increase water storage, the department will restore and cover an empty reservoir at the long-closed Upper Roxborough Plant.

The Microwave Grid: Towards Computer Control

While improving storage, the department was developing more efficient ways to distribute its water to consumers.

Improved control had already become a reality at the Microwave (or Load Control) Center. There a five-year old computer was digesting an unending stream of data, relayed by microwave from distant pumps and valves. This data included water elevations, flows, and pressures. Center operators in turn regulated remote pumping stations and reservoirs by microwave signal.

To provide back up for the existing computer, the department awarded a \$109,000 contract in 1975 for a new central processor. This second computer will increase the capacity of the center for receiving, storing, and acting upon the flow of microwave data. It will also measure electric power demand in the field, and make it possible eventually to have completely automatic control of distant facilities without the intervention of a center operator. This is in line with the city's automation plan for the water system.

The department was also extending its microwave system. In December, 1973, the Race Street High Pressure Pumping Station, which supplies water for center city fires, was linked to the microwave grid. In the future, the Fairhill High Pressure Station, the Somerton and Roxborough Tanks, and the East Park Reservoir will also be brought under microwave control. All other pumping stations and most filtered-water basins are already so controlled.

In most of the 15 pumping stations, outdated vacuum-tube equipment used for microwave had been replaced with solid state devices. In 1975 the transistorization of

yet another station, Fox Chase Booster, was completed at a cost of \$16,500.

Improvement of Water Pumping

At the city's modern pumping stations, there were few other changes.

In the autumn of 1973, however, the flow of water was improved to a riverside pumping station which supplies the Belmont Treatment Plant. Silt had accumulated almost to water level at the intake basin of the Belmont Raw Water Station. As a result, the station pumps had lost efficiency. To correct this, a contractor dredged 4,000 cubic yards of silt and debris from the basin and two concrete aprons. This was done under a \$43,500 contract.

In 1975 a contractor completed the installation of new switchgear, related electrical equipment, and a roof at the Queen Lane High Service Station, at a cost of \$285,585. This station pumps water to Roxborough, Manayunk, and Chestnut Hill.

Because of earlier additions to pumping capacity, no new pumps were installed in the stations. Two new pumps, each with a daily capacity of 60 million gallons, will be placed in the Torresdale Raw Water Station in 1976.

On the average, the three raw water stations pumped 146 billion gallons of water to the treatment plants each year, or about 400 million gallons daily. Of the water which reached consumers, over two-thirds was pumped or repumped by distribution stations and the rest flowed by gravity.

From July 1, 1973 to December 31, 1975, the high pressure stations pumped 75.4 million gallons of water for 97 fires.

New Mains for Efficient Water Delivery

New pipelines were enlarging capacity, improving

pressures, and reducing corrosion throughout the water system. They were also preserving the quality of water as it flowed to consumers.

In 20 years, the Water Department had built 690 miles of water mains, bringing total water main mileage to 3,240 on June 30, 1973.

This pipeline network reached into all neighborhoods of the city, supplying homes, stores, and industries. Only a few houses still drew water from wells.

The tempo of construction continued in 1973-75. From July 1, 1973 to December 31, 1975, the department built 34 miles of mains. Total system mileage rose to 3,254.

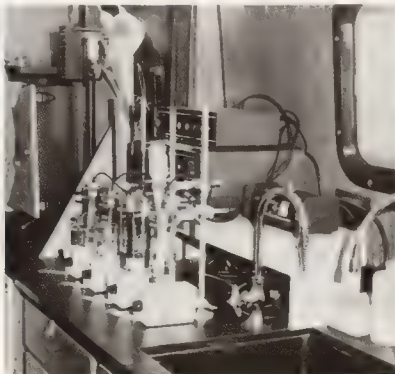
Much of this construction was for the replacement of old mains, which had become corroded or weakened or partially obstructed by years of service. Philadelphia in fact had more than 600 miles of mains that had been laid before 1890.

A typical job in 1974-75 was the replacement of an old cast iron main in 8th Street between Market and Race Streets. A new eight-inch steel main was laid under contracts totaling \$276,000, thus reinforcing the high pressure system in center city.

To facilitate construction of a new Robin Hood Dell for musical concerts, the Water Department began to relocate a four-foot diameter main in Fairmount Park. This job, which will be finished in 1976, will cost \$203,000.

As it had done in past years, the department reconditioned some old mains that were still serviceable. Thus in West Philadelphia, it cleaned and cement lined several old mains in the vicinity of 57th and Arch Streets. This \$383,000 job improved water pressures and reduced water discoloration.

To check on corrosion in older mains, distribution crews cut sections (or coupons) from mains in areas supplied by the Queen Lane Plant. This physical investigation will be extended to other parts of the city in 1976, as a prelude to further cleaning and lining.



New Mobile Laboratory: To test water delivered to consumers, a new laboratory "on wheels" was put into service. Equipped with electronic testing devices, the mobile lab will help to assure fine water at the householder's tap. Philadelphia is the first American City to acquire a mobile water laboratory.

Lime Feed: Old problems caused by lime dust and the settling of lime in conduits and basins were eliminated at the Torresdale Water Plant, when new lime feeders, slakers, and dust collectors were installed.

Old valves stuck in position posed another problem for the Water Department. To provide better control of water flow, a contractor replaced eight huge valves that regulate large supply mains. The new vertical gate valves, four feet in diameter, were inserted into chambers located at Tacony and Fraley Streets and at Kensington and Torresdale Avenues. The cost of the job was \$394,970.

The need for new water mains and control valves will continue to be pressing. To meet such need, the city has scheduled over \$5 million yearly for the next six years. Much of this money will be used for the replacement of worn out mains that date back 75 to 100 years.

Vital, however, will be a first-time pipeline across the Schuylkill River, from Upper Roxborough to West Philadelphia. This \$1.4 million main, scheduled for 1978, will provide a standby source of water for higher elevations, such as Wynnefield and Overbrook. At present, these neighborhoods rely solely on a pumping station at the Belmont Plant.

Plans for 400,000 Magnetic Meters

Because of past replacement or overhaul, most of the city's water meters were in good condition. As a result, the public paid only for the water it used.

The Meter Repair Shop completed nearly all of the thousands of jobs which it scheduled each year. It was repairing or replacing over 45,000 meters annually. At the end of fiscal 1975, there were only 215 jobs still on hand.

As a result of this performance, the number of non-registering, leaking or otherwise malfunctioning meters was only 11,000 in fiscal 1974 and less than 8,800 the following year. This was less than 2% of the 521,000 meters in the system.

As part of its maintenance goals, the department continued to "rotate" many meters from home to shop

and back to home. On the average, 24,000 such meters were being rotated yearly. Thousands of other meters, including some industrial giants, were overhauled in the field.

There were plans to improve the metering system further. During the next 10 years, the Meter Shop will replace 400,000 mechanical-drive meters with meters of the magnetic type. These will supplement 100,000 magnetic meters already in the system.

The new meters will be of the small, 5/8-inch type used in homes and businesses.

Magnetic meters, it is believed, register more accurately and are useful longer than other types. They are also more reliable, more readable, less costly to repair, and more adaptable to remote reading.

Water System Maintenance

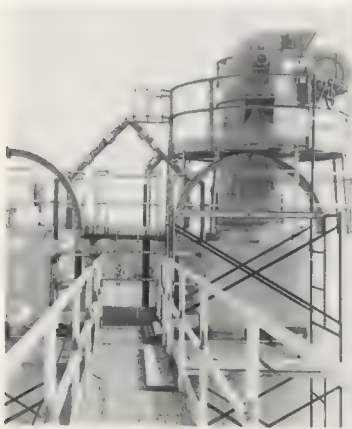
Distribution: Summer's heat and winter's cold were constant challenges to distribution crews. Out on the street 24 hours daily, they kept the water flowing through city mains. They repaired mains, serviced fire hydrants, replaced valves, installed ferrules, and performed many other tasks. Despite a shortage of personnel, they met or surpassed most of the statistical job goals set for them by management.

Some nagging problems kept the crews continually moving.

On hot summer days, hundreds of fire hydrants were illegally opened by the public, causing water pressures to drop in many parts of the city. Distribution crews lost many hours shutting off the hydrants.

To prevent unauthorized opening of hydrants, the department installed up to 2,000 locking devices yearly. Many of these locks, however, were successfully smashed or removed by the public.

To solve this problem, the distribution crews experimented with a heavy steel cap. This cap, shaped like a



For Better Water: New towers rise at the Belmont Treatment Plant. The towers will blow pebble lime by vacuum to an upper storey of the chemical building for storage and use in water purification.

A Long Range Plan: To provide better service for its customers, the department will replace 400,000 small water meters during the next 10 years. Mechanical-drive meters will give way to meters of the magnetic type, shown in photograph.

shallow disk, locked into place on the hydrants. It could be removed only with a special tool.

Five hundred such caps were tested in 1975, and 1,000 additional were purchased for future use.

This new cap may also ease another problem—the continuing theft by the public of 6,000 hydrant caps yearly. The replacement of such caps each year costs \$50,000 for materials alone.

Because of mild winters, water main breaks were fewer than in some past years. Most of the breaks were in small mains, built before 1910.

Among jobs performed by the distribution crews were:

	1973-74	1974-75
Water Mains Repaired.....	699	757
Ferrules:		
Installed.....	3,435	3,614
Drawn or Shut off.....	2,454	2,452
Pipeline Valves:		
Inspected.....	31,399	28,869
Repaired.....	5,451	4,441
Installed.....	396	301
Fire Hydrants:		
Inspected.....	44,327	37,845
Repaired.....	10,363	12,656
Renewed.....	222	202
Installed First Time.....	30	18
Painted.....	6,505	5,396
Valve Chambers Built or		
Rebuilt.....	—	20
Fire and Supply Connections		
Made.....	113	117
Joint Leaks Repaired or		
Caulked.....	225	166
Complaints Investigated.....	18,024	18,192
Water Services:		
Shut off for Delinquency.....	7,881	6,896
Restored.....	4,347	4,806
Fire Flow Tests Conducted.....	95	85
New Water Mains Placed in		
Service after Inspection of		
Contractor's Work.....	10.4 miles	10.7 miles

Building Maintenance: Employees of Building Maintenance performed over 2,200 jobs yearly. These ranged from the installation of plumbing and partitions in buildings to the dredging of the river in front of the Torresdale Plant intake. Of special interest was the restoration of old water works machinery, dating from 1851, at the long closed Fairmount Pumping Station.

The unit's security patrols covered more field facilities than ever before.

Machine Shop: More and more work flowed into the Machine Shop from other divisions and City agencies. Notable was the large amount of repair done on truck bodies, and on special pieces of equipment. The shop salvaged \$136,000 worth of discarded metal pieces in 1973-75.

Automotive Maintenance: In 1976, the department will build a new Automotive Equipment Repair Facility to replace its old Logan Garage. The new \$3 million structure was under design in 1975. It will include a prefabricated metal building for body work, storage of parts, and employee accommodations, as well as parking area and gasoline pumps. It will be located on 4.2 acres near the present Distribution Headquarters.

The Logan Garage, together with a newly opened branch at the Northeast Plant, performed thousands of jobs yearly on Water Department vehicles and "off-the-road" equipment. These jobs included both repair and preventive maintenance.

The City Managing Director commended the Logan Garage for having the lowest average vehicle downtime of any City agency.



Reservoir Cover: Workmen place a gigantic floating cover of synthetic rubber on the north basin of the Oak Lane Reservoir. The Water Department plans to cover all its open reservoirs to protect purified water from algae and contamination.

For Improved Distribution: New valves go into a large supply main in Northeast Philadelphia. Replacing old valves that were difficult to operate, the new valves will improve control over water delivery.

WATER PUMPED, TREATED, USED—1973-75

By Fiscal Year . . . in Millions of Gallons Daily

1. Raw Water Pumped to Treatment Plants

	1973-74	1974-75
Belmont Pumping Station	166.9	69.8
Queen Lane Pumping Station.....	108.8	108.0
Torresdale Pumping Station.....	<u>222.4</u>	<u>223.4</u>
	398.1	401.2

2. Filtered Water Pumped to Consumers

	1973-74	1974-75
Delaware Pumping Stations:		
Fox Chase Booster.....	12.8	11.4
Lardner's Point	145.5	144.7
East Oak Lane Tri-service.....	19.6	23.1
West Oak Lane	10.4	11.8
Torresdale—		
• High Service.....	19.4	19.8
• Low Service.....	46.8	43.3
• To Bucks County	5.9	6.9
Schuylkill Pumping Stations:		
Belmont High Service.....	11.7	12.3
Chestnut Hill High Service.....	.0	.0
East Park Booster.....	2.4	1.3
Queen Lane—		
• High Service.....	11.4	12.6
• Roxborough Express	22.9	19.7
Roxborough High Service	10.2	7.9

3. Filtered Water Output of Treatment Plants

	1973-74	1974-75
Belmont Treatment Plant.....	63.1	66.8
Queen Lane Treatment Plant.....	106.0	104.4
Torresdale Treatment Plant.....	<u>219.1</u>	<u>217.6</u>
	388.2*	388.8*

4. Filtered Water Used by Consumers

	1973-74	1974-75
Belmont Treatment Plant.....	62.4	64.9
Queen Lane Treatment Plant.....	94.4	91.3
Torresdale Treatment Plant.....	<u>205.7</u>	<u>201.1</u>
Daily Average Distributed to City.....	362.5	357.3
Delivered to Bucks County from the Torresdale Plant.....	5.9	6.9
	368.4**	364.2**

Total Fiscal Year Figures In Billions of Gallons Yearly

	1973-74	1974-75
Total Raw Water Pumped.....	145.3	146.4
Total Water Filtered	141.4	141.9
Total Water Delivered to the City	132.3	130.4
Total Water Delivered to Bucks County	2.2	2.5

Some Calendar Year Figures In Millions of Gallons Daily

	1974	1975
Water Delivered to City Consumers	355.7	371.0
Water Delivered to Bucks County.....	6.4	7.1

In Billions of Gallons Yearly

	1974	1975
Total Raw Water Pumped.....	145.3	144.4
Total Water Filtered	141.7	140.8
Total Water Delivered to the City	129.8	135.4
Total Water Delivered to Bucks County	2.3	2.6

*The filtered water output of the treatment plants was less than raw water pumped to the plants. Basin evaporation largely accounts for the difference.

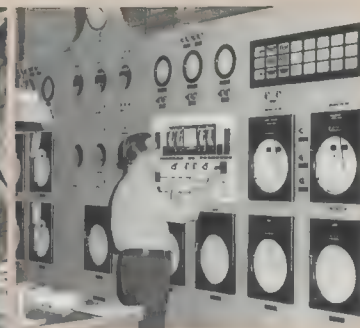
**Water use by the public was less than plant output since some water was used for washing filter beds, etc., at the plants.

How Philadelphia Drinking Water Compares with National Quality Standards of the Environmental Protection Agency Fiscal 1975

Parameter	EPA Primary Standard	BELMONT Plant Effluent	QUEEN LANE Plant Effluent	TORRESDALE Plant Effluent
Arsenic	0.05	0.010	0.006	0.000
Barium	1.	0.00	0.00	0.00
Cadmium	0.010	0.000	0.000	0.000
Chromium	0.05	0.000	0.000	0.000
Lead	0.05	0.003	0.004	0.003
Mercury	0.002	0.0003	0.0003	0.0000
Nitrate (as N)	10.	2.49	2.63	1.16
Selenium	0.01	0.00	0.00	0.00
Silver	0.05	0.000	0.000	0.000
Fluoride	1.8	1.01	0.84	0.94
Pesticides				
Endrin	0.0002	0.0000	0.0000	0.0000
Lindane	0.004	0.000	0.000	0.000
Methoxychlor	0.1	0.00	0.00	0.00
Toxaphene	0.005	0.000	0.000	0.000
2,4-D	0.1	0.00	0.00	0.00
2,4,5-TP	0.01	0.00	0.00	0.00
Turbidity	1. T.U.	0.35	0.30	0.19
Coliform (MF)	1/100 ml	0.020	0.008	0.004
Gross Alpha Activity	15 pCi/l	0.3	0.3	0.3
Gross Beta Activity	50 pCi/l	2.2	2.4	1.7

All figures in milligrams per liter unless otherwise specified

Note: Philadelphia's drinking water is better than standards set by the Environmental Protection Agency. Its "parameters" meet or fall below maximum limits permitted by EPA.



Water Main Inspection: Many miles of old water mains were inspected to determine the need for cleaning or replacement. Crews cut coupons, or segments, from mains to examine them.

Improved Technology: An All-automatic system for applying ferric chloride was installed at the Torresdale Plant, where ferric chloride helps to settle out water impurities.

CHEMICAL AND ELECTRIC POWER COSTS

By Fiscal Year

1. Chemical Costs for Water Treatment (per million gallons)

	1973-74	1974-75
Belmont Treatment Plant.....	\$10.99	\$19.20
Queen Lane Treatment Plant.....	13.06	23.33
Torresdale Treatment Plant	10.41	16.58

Note: The Water Department used 51,585,659 pounds of chemicals at its plants and reservoirs in fiscal 1973-74, and 53,748,730 pounds the following year. The cost increased from \$1,548,659 in fiscal 1973-74 to \$2,568,002 in fiscal 1974-75.

2. Electric Power Use in Water Treatment (in millions of kilowatt hours)

	1973-74	1974-75
Belmont Treatment Plant.....	2.10	2.02
Queen Lane Treatment Plant.....	2.58	2.40
Torresdale Treatment Plant	4.49	3.78

3. Electric Power Costs for Water Treatment (per million gallons)

	1973-74	1974-75
Belmont Treatment Plant.....	\$ 1.65	\$ 2.19
Queen Lane Treatment Plant.....	1.20	1.67
Torresdale Treatment Plant	1.01	1.26

Note: Total power costs for treatment in fiscal 1974-75 were \$297,475, or nearly \$815 daily.

4. Electric Power Costs for Pumping

	1973-74	1974-75
Average Cost to Pump a Million Gallons 100 Feet High.....	\$ 7.13	\$10.58
Cost to Pump a Million Gallons to Consumers	24.07	36.02
Cost to Deliver 1,000 Cubic Feet to Consumers.....	0.18	0.27

Note: The total power cost for pumping in fiscal 1974-75 was \$4,686,600, or \$12,840 daily. Power costs for pumping and treatment combined were nearly 47% higher than they were the year before.



Towards Automation: The city's modern water plants will be the first in the world to be monitored and operated by computer. Automation, which will be instituted in the next few years, will improve water quality and lower operating costs.

The Rivers

Monitoring the Rivers from Earth and Space

After 15 years of constant monitoring, the Water Department knew much about the Delaware and Schuylkill Rivers. It had accumulated a mountain of data on a variety of changing stream conditions.

To make this data available, the department was loading it into a national storage and retrieval system maintained by the Environmental Protection Agency.

The department also prepared a major report in 1975. The report, which analyzed statistical data collected for the Delaware River (1962-72), will be released in 1976.

Philadelphia was in a good position, indeed, to explain long-term trends in stream quality. The city's river studies went back to the 1940's, but since 1960 the Water Department and the U.S. Geological Survey had jointly monitored the rivers 24 hours daily. Eight automatic stations, equipped with electronic instruments, analyzed and measured the daily flows.

The instruments reported on dissolved oxygen, chlorides, temperature, turbidity, "pH", and other stream characteristics. At the same time, gauges recorded flow rates and water heights.

In the spring of 1973, a daring experiment began at the monitoring stations. The stations were linked to a space satellite launched by U.S.G.S. Twice a day, "sending platforms" encoded data from the monitoring instruments and relayed this data to the passing satellite. The satellite in turn transmitted the data to ground centers, where it was decoded and sent by land wire to teletype receivers in U.S.G.S. and Water Department offices.

This successful experiment was discontinued in 1975, but U.S.G.S. was planning to replace it with continuous monitoring, utilizing a satellite that will keep pace with the earth's rotation.

Fixed monitors and space satellites were only part of the city's stream surveillance. The Water Department also operated a small "navy".

Thus a laboratory-equipped cabin cruiser, the Aquadelphia II, made weekly runs on the Delaware River, collecting and testing water samples from Marcus Hook, Del., to Trenton, N.J. Samples were collected at 23 points and analyzed for 35 "parameters" or conditions.

The lab boat also made periodic surveys of the river (and several tributaries) from Trenton to Easton, Pa., and made monthly runs for U.S.G.S.

The department used a small 12-foot boat upstream to collect water samples for the Torresdale Quality Control Laboratory, and in 1975 it purchased a 17-foot Boston whaler to check on outfall overflows and other river pollution. Regular sampling runs were made by car along the upper Schuylkill River.

As part of its continuing studies, the department will install samplers on the Delaware River and its tributaries to collect plankton in 1976. It will also add "weather" equipment (for measuring wind, sunlight, humidity, etc.) to the electronic testing equipment already on board the Aquadelphia.

Seeking the Sources of Stream Pollution

To learn more about stream pollution, the department worked closely with many public agencies. Several special studies were under way.

From July 31 to August 13, 1975, the Aquadelphia II joined boats from other public agencies to collect thousands of water samples, from the Delaware Bay to Trenton. The two-weeks study, followed by months of laboratory testing and mathematical analysis, formed one of the most intensive surveys of the Delaware River ever undertaken.

An immediate purpose was to provide data for the creation of a two-dimensional, mathematical model of



Stream Study: In an underground chamber in the Northeast, an engineer checks automated equipment that monitors storm water overflow into streams. During storms, the bottles fill automatically at pre-set intervals, and samples are later analyzed.

the estuary. The 1975 data will be used to calibrate the model, and a second survey in the spring of 1976 will verify it.

The model will be used by regulatory agencies to (1) assess the pollutional effects of inflows into the estuary from creeks, sewers, sewage plants and industries, (2) prepare more realistic standards for the protection of stream quality, and (3) create a comprehensive water resources management plan for Southeastern Pennsylvania, as required by federal law.

The new model will replace an older one-dimensional unit—a replacement long urged by the Water Department. The inadequate, older model had given rise to unsatisfactory quality standards for the river.

Of the \$750,000 cost of the study, the Environmental Protection Agency will provide \$600,000. The Water Department will supply \$42,000 in boat and laboratory services. Other study participants are the Delaware River Basin Commission (the coordinator) and the States of Pennsylvania, New Jersey and Delaware.

Other Studies: The Water Department and the U.S. Geological Survey were looking closely at two sources of stream pollution. One of these was storm water overflow; the other urban development. These studies were being financed jointly by the two agencies.

1. To determine the pollutional effect of storm water, the department constructed a subterranean chamber at Bustleton and Tustin Avenues. In this chamber the U.S.G.S. installed several automatic monitoring devices which it had developed for the study.

These devices sampled the flow in a large storm water sewer and time-correlated the flow with readings from local rain gauges. The resulting data was relayed by land wire to a teletype receiver in the department's Engineering Computer Center.

As part of the study, the department was also testing and verifying a "storm water management" model deve-

loped by E.P.A. This model presumably simulates the effects of urban runoff.

The \$56,000 study will continue through 1976.

2: The effect of urban development on creek pollution and flooding was also studied. Working along 14 creeks, sanitary engineers collected rainfall measurements from rain gauges, and water quality data from influent and effluent stations. Stream flow rates and volumes were also monitored. For the purpose of the study, seven five-square mile and seven one-square mile drainage areas were demarcated along the creeks. The \$110,000 study will require from three to five years.

Condition of the Rivers

For the fourth straight year, the rains were abundant on the Eastern Coast. The effect in the Delaware Valley was to swell the flow of streams, and to improve the quality of the river water.

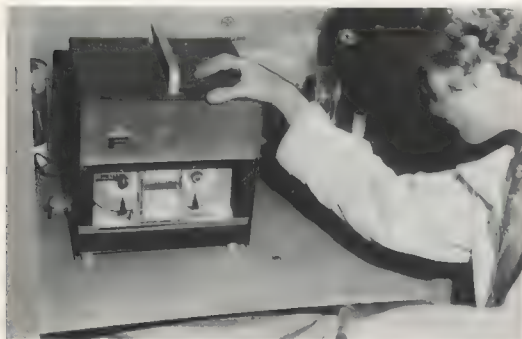
Thus dissolved oxygen averaged from 7 to 9 parts per million at the city's intakes on the rivers. The oxygen was sufficient to freshen the river water, and to facilitate treatment at the plants.

Turbidity was low in both rivers, and changes in other conditions had little effect on the average quality of the streams. Up the Delaware, fecal coliform were traced to repeated dumping at Trenton, but this was a local problem that did not affect the Philadelphia intake.

Hardness declined in both rivers. Measured in grains per gallon, the average annual hardness was—

	1972-73	1973-74	1974-75
Delaware River.....	3.7	3.4	3.3
Schuylkill River.....	8.4	7.9	7.4

Monthly hardness in the latter two years fluctuated from 4 to 12.3 grains per gallon in the Schuylkill, and from 2.1 to 4.7 grains in the Delaware.



Stream Gauge: Flow rates and water volumes were measured in creeks by a network of stream gauges. The Water Department maintains such gauges to study the pollutional effects of urban runoff.

Tocks Island Dam: This vital dam, proposed for the Delaware River, would create a 37-mile long lake, thus assuring a dependable water supply for Delaware Valley communities.

On the Delaware, where the estuary is influenced by the tides, chloride averaged only 11 to 15 parts per million at the Torresdale intake. This was chloride that occurs naturally in the fresh water rather than in the tidal flow.

Stream Flows: Because of the ample rainfall upstream, the river flows were greater than the long-term averages. These flows, measured in cubic feet per second, were as follows:

	Water Year Oct. 1973— Sept. 1974	Water Year Oct. 1974— Sept. 1975	1931-60 Average
*Delaware River..... (at Trenton)	14,050	15,533	12,400
*Schuylkill River (at Fairmount Dam)	3,363	4,077	2,921

The sizable stream flows helped to dilute the occasional spills of oil. Though most of the spills were minor, three intrusions into the Delaware in fiscal 1974 totaled 430,000 gallons. None affected the quality of the finished water distributed by the city's treatment plants.

More serious were three spills of a chemical which passed through the Reading Sewage Plant in the spring of 1975, and may have originated with a manufacturer of paints and lacquers. The chemical gave a bitter taste to drinking water in communities along the Schuylkill River. Philadelphia twice avoided the chemical by closing its intakes.

Closely monitoring these and other spills, the Water Department reported them to regulatory agencies, which took necessary action.

Rainfall: Once more the department's extensive rain gauge network proved its value. The 31 gauges within the city and 17 in the suburbs provided a more comprehensive record of local rainfall than did the single gauge of the U.S. Weather Bureau at International Airport. Measured in inches, the average readings in the city for three fiscal years were:

	1972-73	1973-74	1974-75
23 Department Gauges.....	60.36	46.61	51.37
**U.S. Weather Bureau..... (Int. Airport)	54.64	37.36	44.49

As measured by Water Department gauges, precipitation varied in fiscal 1975 from 55-60 inches in Northwest Philadelphia to 40-45 inches in the extreme south of the city. This followed a long-term distribution pattern for city neighborhoods.

*All flow figures for the Delaware River are unadjusted for upstream diversions. Flows figures for the Schuylkill River have been adjusted to reflect withdrawals of water by Philadelphia.

**Rainfall at the airport was higher in fiscal 1975 than local long-term averages recorded by the U.S. Weather Bureau, but it was lower in the two preceding years. These averages are: 40.91 inches in the period 1872-1966; 42.48 in 1931-60; and 39 inches in 1958-67.

Rainfall data is used by the department to study storm trends, design better drainage, investigate stream quality, learn more about flooding, and provide evidence in law suits.

Within the next few years, the department will replace its standard weighing gauges with tipping bucket gauges. The latter will permit the transmittal of rain data by land wire to a central point, thus saving many man hours. These gauges will also empty automatically.

In 1975, the department installed nine tipping bucket gauges along streams in the suburbs, and five in the city.

Tocks Island Dam—Needed for Stream Quality

As 1976 began, some communities had an unanswered question about the Delaware River. Would a cross-river dam ever be built at Tocks Island?

This dam had long been planned by the member states of the Delaware River Basin Commission. Estimated to cost \$400 million, it would form a 37-mile long artificial lake to provide a number of benefits for Delaware Valley communities.

In July, 1975, however, the Basin Commission acceded to a request by the State of New Jersey. The latter asked that action on the dam be suspended until some distant future when a dam might be needed by that state.

Although some "environmental" groups applauded this decision, the commission did not deauthorize the dam.

Philadelphia, the State of Pennsylvania, and other public and private entities strongly opposed the delay. They argued that the need for the dam and lake was immediate, rather than distant.

They noted that— as population and industry increase—more and more water will be taken from the Delaware River. The new dam and lake would help to meet these needs.

The dam would also assure an inflow of at least 3,000 cubic feet of fresh water per second into the Delaware estuary—even in time of drought. Such minimum inflow is necessary to protect estuary water quality, help communities build new sewage plants that meet federal stream standards, and keep oceanic salt water out of Camden's wells and Philadelphia's intake.

The Tocks Island project would also create a large recreational area, help develop badly needed electric power, and guarantee adequate flood control along the river. The deep waters of the new lake would harbor healthy fish, oxygen-creating algae (to improve water quality) and pleasant sand beaches. Regional sewage treatment plants would protect the lake from pollution.

Despite these benefits—and the willingness of the Federal Government to pay construction costs—the future of the Tocks Island project was much in doubt.

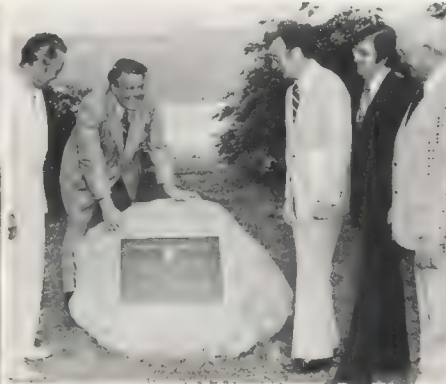
Our Historic Past

National honors come to the Old Fairmount Water Works



Old Fairmount Needs Restoration

The venerable buildings of Fairmount deteriorate with each passing year. Today the Fairmount Park Commission, the Water Department, and the Junior League of Philadelphia are seeking means to restore these buildings for posterity.



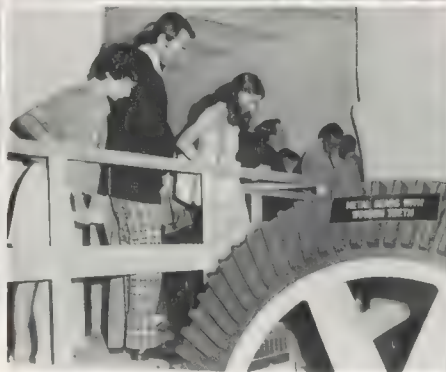
The old Fairmount Water Works—an outstanding engineering feat of the early 19th century—was honored on June 17, 1975 by the American Society of Civil Engineers. National A.S.C.E. President William M. Sangster (touching rock) presents a bronze plaque that designates Fairmount a "National Historic Civil Engineering Landmark." Hundreds of guests attended ceremonies and saw surviving machinery.



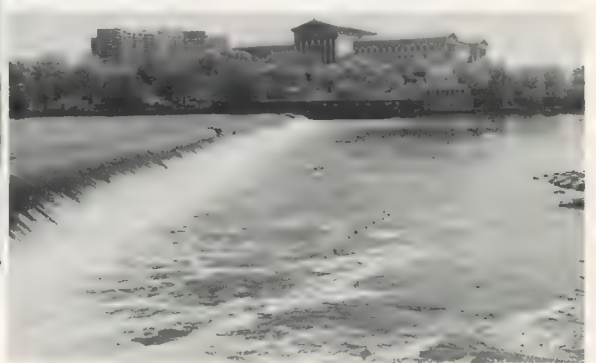
Fairmount Works in 1829: Built between 1812 and 1822, the Fairmount Station pumped water from the Schuylkill River to the hill now occupied by the Museum of Art.



About 1900: Cast iron mains span the forebay at the back of the Fairmount Works. The mains carried water to reservoirs.



An Engineering First: Fairmount was the first water works in America to use water wheels and water turbines. Turbines, gears, and expansion tanks are shown (above) in 1876.



The Wastewater System

A Reduction in Stream Pollution

Although a quarter-century old, Philadelphia's "water pollution control" plants were doing much to protect the rivers. In fiscal 1975, they treated 169 billion gallons of wastewater (sewage) from Philadelphia and neighboring communities.

From this flow they removed 102,000 tons of suspended solids, and discharged to the rivers a cleaner effluent than the state required. This efficient treatment had been typical for a number of years.

Thus plant effluent in fiscal 1974 carried only 307,700 pounds of biochemical oxygen demand (B.O.D.) daily to the rivers, and in fiscal 1975 this dropped to 258,000 pounds daily. These discharges were much below the 332,000 pound limit permitted by the state.

Because B.O.D. poundage is a measure of pollution, the city's plants were helping to maintain stream quality.

To reduce pollution discharges to the Delaware estuary, the Northeast and Southwest Plants did much waste recycling. At Northeast, there were also improvements in wastewater treatment, that included flow equalization and modified aeration in all aeration basins.

Difficult industrial wastes kept B.O.D. removals somewhat below plant design at the Northeast Plant, but at the other two plants the removals were close to or above design levels. This was also true of suspended solids.

These removals were made by the plants despite rising wastewater flows. In fiscal 1974, incoming wastewater averaged 464 million gallons daily—the sixth new flow record in six years. In fiscal 1975, this new record was repeated, and in calendar 1975 wastewater soared to 477 M.G.D. During the two fiscal years, the flows exceeded plant capacity by 12 to 20 million gallons daily.

A \$414 Million Plan to Improve the Rivers

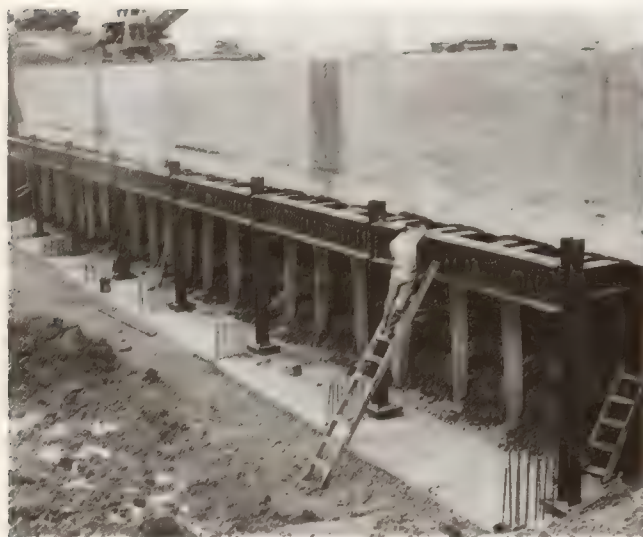
Despite past successes, Philadelphia was looking ahead. To meet rising wastewater flows and new federal stream standards, the Water Department had prepared a massive plan. In the autumn of 1975, it began a \$414 million expansion and modernization of its water pollution control plants.

This program had long been delayed by complex and changing federal regulations. These—and the partial impoundment of federal funds nationally—had impeded the start of construction for three years.

The department, however, had pressed firmly ahead with planning. In 1973-75, design work for the new plants moved steadily across the drawingboards . . . contract plans and specifications were written . . . and voluminous funding applications and reports were submitted to the Federal and State Governments.

Thus when remaining federal funds were freed by the

	Northeast Plant		Southeast Plant		Southwest Plant	
	F1974	F1975	F1974	F1975	F1974	F1975
Flow—Million Gals/Day	195	189	121	119	148	156
% of B.O.D. Removed	64	65	36	40	41	33
% of Susp. Solids Removed	70	67	55	69	51	54



Waterway: A new waterway opening (above) will connect Mingo Creek with a huge surge basin to be built in 1976. The basin will receive back-up waters from Mingo Creek during storms.



Inlet Cleaning: Each of the 75,000 sewer inlets in the city received at least one cleaning each year. Vector jets and muscle power removed 1.7 million cubic yards of debris annually.

courts in the spring of 1975, Philadelphia was ready. On October 10 Mayor Frank L. Rizzo broke the first earth for construction at the Southwest Plant, and by December 31 the city had awarded, or was processing, \$99 million of contracts for new facilities at the Northeast and Southwest Plants.

To free space for expansion at the Northeast Plant, the department was planning to remove 365,000 cubic yards of digested sludge from two lagoons. Contract bids for removal were opened in December, 1975, after federal and state objections had delayed the project for two years.

The pace of construction—and contract award—will quicken in 1976 as the department presses toward new target dates. These dates, approved by the regulatory agencies,* provide for a new plant at the Northeast Works by January 1, 1979, and modernization of existing facilities there by January 1, 1981. They also include expansion and modernization of facilities at the Southwest Plant by January 1, 1979, and at the Southeast Plant by January 1, 1980.

Inflation and federal delays have raised the cost of plant expansion. This cost jumped from \$100 million in 1970 to \$414,166,000 early in 1976. This includes \$140,360,000 for Northeast, \$168,958,000 for Southwest, and \$104,848,000 for Southeast. Plan revisions have restrained cost rises at Southeast.

Building New Plants with Improved Features

To protect its streams, Philadelphia will build new wastewater plants that will be among the most technically advanced in America. Incorporating automation, enlarged capacity, and improved treatment, these plants will be superior to some federal requirements.

*Delaware River Basin Commission, Pennsylvania Department of Environmental Resources, and Federal Environmental Protection Agency.

Upgrading of Treatment: The plants will provide for screening, primary settling, oxygenation, final settling, and chemical treatment of wastewater, as well as sludge digestion. Both aerobic and anaerobic bacteria will aid the treatment process.

These treatment steps, to be applied at all the plants, include refinements and additions to methods now used by the city. Thus—

- There will be more treatment stages, and longer retention of wastes during treatment, to improve the removal of pollutants,

- Aeration basins will be covered for the first time, and oxygen will replace air to make this stage of treatment more efficient,

- Plant effluents will be chlorinated, or otherwise disinfected,

- The Southeast and Southwest Plants will be upgraded from "primary", and the Northeast Plant from "intermediate", treatment to full "secondary" treatment.

As a result, the new plants will remove over 92% of pollution, as measured by biochemical oxygen demand (B.O.D.), from wastewater. This is seven percentage points higher than federal law requires for new secondary wastewater plants.** It will also be a marked improvement over the 50% to 55% (combined average) removed by the existing plants in 1973-75.

By 1981, therefore, Philadelphia will discharge a relatively clean effluent to the Delaware estuary. This effluent from the wastewater plants will be limited to 131,500 pounds of carbonaceous oxygen demand daily. Not only will this meet federal stream standards, but city pollution loads entering the stream will be reduced by 70% or more.

**The National Water Pollution Control Act requires communities to provide "secondary" treatment of wastewater. This has been interpreted to mean 85% removal of biochemical oxygen demand from wastewater.



Modern Laboratories: City technicians use the finest equipment to ensure high standards of wastewater treatment. High-powered microscopes and automatic analyzers reveal nutrients, bacteria, and other wastewater constituents.

Automation: Reinforcing the improved treatment will be plant automation. The plants will be equipped at every treatment stage with electronic sensing devices, which will report the condition of wastewater to computers. The computers in turn will control the treatment processes, by sending "orders" to distant equipment.

Enlarged Capacity: The new plants will be designed to receive the rising wastewater flows from the city and outlying communities.

To handle such flows, the treatment capacity of the Northeast Plant will increase from 175 million gallons daily to 250 million. That of the Southwest Plant will climb from 136 million daily to 210 million.

The Northeast and Southwest Plants will become more truly "regional", as additional suburban flows reach them. Thus the improved Southwest Plant will receive up to 50 million gallons of wastewater daily from fresh areas of Delaware County. Suburban areas served by the Southwest Plant will increase eventually from the present 38 square miles to 128 square miles.

At the request of the Federal and State Governments, the capacity of the Southeast Plant may be reduced from 136 million gallons daily to 100 M.G.D. This plan depends upon the elimination of ground water infiltration into sewers supplying the plant. The new plant will be so designed that its future capacity can be easily increased if necessary. The Southeast Plant presently serves a stable population.

Studies to Aid Plant Expansion

In preparation for plant expansion, the Water Department was doing many complex studies. Some of these were related to plant design, others to federal and state requirements.

New Treatment Methods: Thus engineers were studying bio-surf units and other means to improve wastewater treatment.

At the Southeast Plant, a polyethylene (bio-surf) roller, 15 feet long and 10 feet in diameter, was rotated through 100,000 gallons of wastewater daily. As it revolved, the roller picked up a film on which aerobic bacteria grew. The bacteria oxidized the sewage, removing over 90% of biochemical oxygen demand.

A smaller bio-surf unit was tested in an aeration tank at the Northeast Plant. Unlike the mechanically driven unit at Southeast, the Northeast unit was driven by air supplied by existing air diffusers. Toward the end of 1975, this unit was replaced with a full-scale 25-foot long unit for additional study.

Although bio-surf units greatly improve treatment, they appear to be too costly for the Southeast and Southwest Plants. There, covered tanks supplied with oxygen are expected to perform as well at less cost.

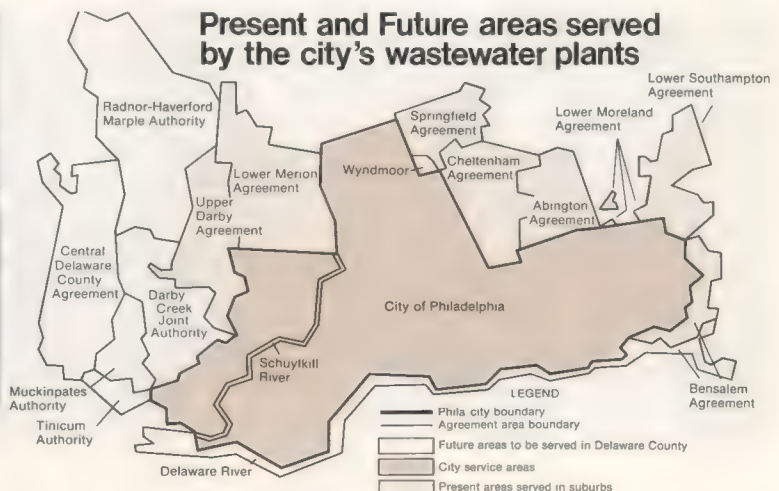
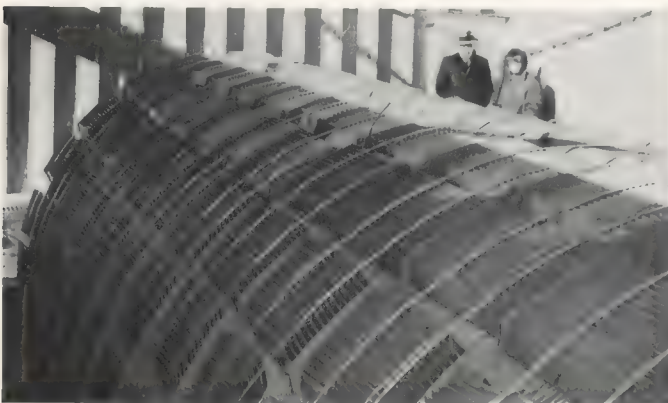
At the Northeast Plant, however, it may be possible to integrate air-driven bio-surf units into the existing aeration tanks at moderate cost.

There were also experiments at the wastewater plants in 1973-75 with electronic monitors. These devices will supply treatment information to future computers.

Federal Requirements: In order to obtain federal construction grants—and comply with state and federal controls—the Water Department made several exhaustive surveys:

1. The department submitted a comprehensive report to the Environmental Protection Agency on the infiltration of ground water, and the inflow of storm water, into the sewers which supply the wastewater plants. The purpose of this study was to determine whether future plant capacity could be reduced by eliminating excessive infiltration-inflow.

As a result of this report, the regulatory agencies reaffirmed the planned capacities for the Northeast and Southwest Plants, but asked that the design capacity for the Southeast Plant be reduced. More intensive surveys



Bio-surf Unit: Huge rollers like this may upgrade wastewater treatment at the Northeast Plant in future years. This bio-surf unit, which is being tested in an aeration tank, is expected to remove over 90% of biochemical oxygen demand from wastewater.

of city sewers will be made in 1976, as a follow-up to this report.

2. The department completed a survey of industries which discharge toxic wastes, or 50,000 gallons or more of other wastes daily. The report to E.P.A. detailed the size and characteristics of wastes attributable to each industry. Most of these wastes reach the city's treatment plants.

Control Act Workshop: The growing pile of technical reports required by state and federal agencies (under the National Water Pollution Control Act) was becoming a burden to local communities. Unrealistic deadlines were adding to this burden.

In 1974, the Water Department arranged a workshop for 200 officials and engineers from Pennsylvania and neighboring states. This workshop, sponsored by the Water Pollution Control Federation and its Pennsylvania branch, examined the National Water Pollution Control Act of 1972 and its administration by federal agencies.

Workshop members adopted more than 40 resolutions calling for improvements in the Act by the Congress and in its implementation by E.P.A.

New Grease Burners to Reduce Odors

While planning for expansion, the department made other improvements at the wastewater plants. These were intended to increase efficiency or provide other benefits.

1. Notable was the erection of pollution-free incinerators at the Southwest and Southeast Plants. Intended to burn grease and oil skimmed from wastewater, the incinerators will (1) help reduce lagoon odors, (2) improve the performance of digester tanks, and (3) provide extra heat for the heating of wastewater sludge. Until now, grease and oil have sometimes clogged the digester tanks and given a smell to disposal lagoons.

The Southwest incinerator, after long trial and some

modifications by the contractor, went into service in December, 1975. That at Southeast was almost finished.

The brick incinerator buildings house two burners each, and the four units will burn a combined 6,000 pounds of grease and oil hourly. The units conform to the city's air management code, will scrub gases fully, and will emit no particulates to the atmosphere. They will be fueled by both natural and sewage gas.

Electrically controlled from panels, the burners will be supported by pumps, scrubbers, and scum breakers.

The cost of the Southwest incinerator was \$975,000; that of the Southeast \$872,750.

2. At the Northeast and Southwest Plants, new roofing was placed on the floating covers of 16 digester tanks. The covers, 110 feet in diameter, float on a cushion of gas.

The contracts, totaling \$484,000, also included roofing for valve houses, pump houses, and pipe galleries.

Plant safety was increased at the Northeast Plant with a massive flood lighting system featuring 100-ft. towers. That plant also received new air conditioning, sludge heater controls, water and sump pumps, a sluice gate slide, and aeration tank walkways.

The efficiency of a sludge digester tank was improved with a gas recirculation system at the Southwest Plant, while at Southeast two new butterfly valves were installed in flocculation channels.

In all, the department invested \$4.1 million in all types of wastewater plant improvements from July 1, 1973 to December 31, 1975.

Ocean Disposal: The City Seeks an Alternative

Disposal of the solids which the city kept out of the rivers was becoming a growing problem. With rising wastewater flows, the plants were producing an increasing volume of digested sludge. In fiscal 1975 this amounted to 195 million gallons—an all time record.

For 14 years the Water Department had barged much of



Grease Burner Building: The odors of grease and oil skimmed from wastewater will be eliminated when this new building at the Southeast Plant goes into service. Equipped with two incinerators, the building will burn up to 3,000 lbs. of grease and oil hourly.

its sludge to the Atlantic Ocean, and by 1975 it was barging up to 150 million gallons yearly. This was the gallonage limit imposed by the Federal Government.

Unfortunately, the plant lagoons were full, and the department had no space for extra sludge. Most of the extra sludge had to be constantly recycled through the plants.

In the autumn of 1975, the Environmental Protection Agency provided some relief. At the department's request, E.P.A. abandoned the liquid gallonage limit on ocean barging, and adopted a limit measured in pounds of solids.

- This relief lasted for a few months only. In June, 1976, E.P.A. restricted ocean barging to 116 million pounds of sludge solids for the ensuing year. This was 25 million pounds below yearly plant production.

Happily, the city's sludge was having little effect on the ocean. The end product of wastewater treatment, this sludge was being processed for a minimum of 25 days. It consisted of 90% water, 5% earth and sand, and 5% organic matter which had been fully stabilized.

Unlike some other communities, Philadelphia was not sending, and had never sent, raw sewage or other deleterious wastes to sea.

Carried to a point 50 nautical miles southeast of Delaware Bay, the sludge was placed in an area chosen by E.P.A. There the currents allowed the sludge to settle to the bottom or bore it well away from Eastern shores.

Controls: The Water Department, in fact, was carefully controlling ocean disposal. In 1973-75, it—

- Did extensive laboratory analysis of all sludge barged to sea,
- Hired Raytheon Oceanic and Environmental Services, of Portsmouth, R.I., to monitor its ocean disposal site for a year at a cost of \$250,000.
- Employed the Marine Science Consortium (consisting of five universities) to reexamine a former disposal

site which Philadelphia had used for 12 years near the New Jersey coast (1961-73).

Thanks to these and other studies, it appeared that ocean disposal of Philadelphia's sludge was environmentally safe. As early as 1972, the Franklin Institute and Thomas Jefferson University (after a year of study) had reported the city's former disposal site to be free of contamination and to contain healthy fish and plant life. The Marine Science Consortium reconfirmed this finding in 1975.

At the close of 1975, the Raytheon Company was still studying the new disposal site. To date, this study had shown no significant damage to ocean waters or oceanic life.

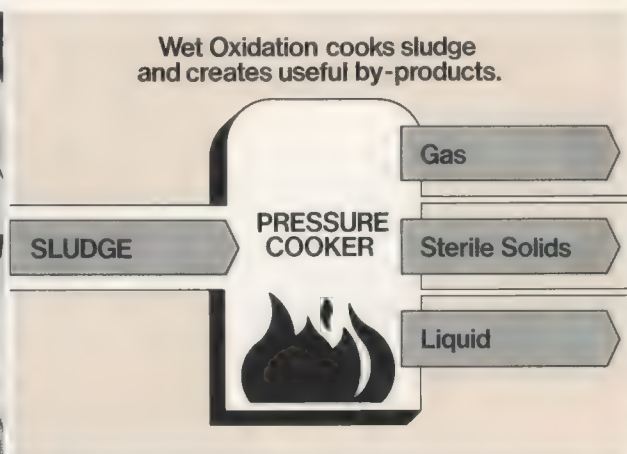
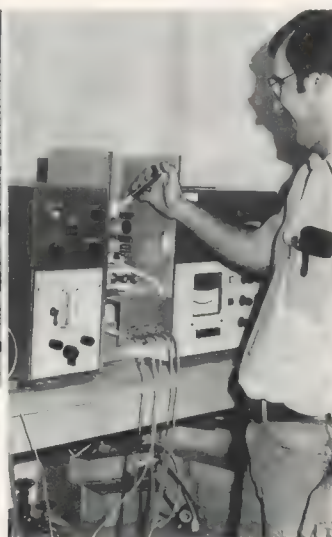
As part of its ocean control program, the Water Department was determining and quantifying all sources of heavy metals in the city's wastewater. Most of these metals came from domestic, rather than industrial, sources.

Fortunately, the concentrations of such metals in digested sludge were infinitely tiny. When mixed with the ocean water, they were measurable in parts per trillion. There was no conclusive evidence that they were accumulating in ocean sediments or organisms.

A Phase-out Order: Besides environmental safety, ocean disposal was economical. In 1975, it cost Philadelphia \$1.6 million, but placement of sludge on land would have cost three to five times as much.

Despite these benefits, the city was under mounting pressure to discontinue ocean barging. Much of this pressure came from special interest groups in neighboring states.

As a result, the Region III (Philadelphia) Office of E.P.A. moved to phase out the city's program. In February, 1975, it ordered Philadelphia to cut ocean disposal in half by January 1, 1979, and to end barging completely by January 1, 1981.



For Safe Ocean Disposal: Sludge barged to sea was carefully tested in Northeast laboratories. This chemist prepares a sludge sample and then screens it for heavy metals in an atomic absorption analyzer.

An Alternative: The Water Department will study alternatives to ocean disposal. These include the Puretec process of sludge treatment (above), which creates by-products.

The Water Department immediately appealed the Region III order to the national E.P.A. administrator. This appeal was based on the fact that (1) E.P.A. had not made an adequate study of the merits of ocean disposal, and (2) Philadelphia would not have sufficient time to test and implement a safe alternate disposal method by the given deadlines.

The city's appeal was denied by E.P.A.

Search for Alternatives: With an eye to the future, the Water Department had been doing sludge research for several years. It had investigated a dozen alternatives to ocean disposal. These included sludge recycling, fertilizer production, and solids preparation for land or high-way fill.

Unfortunately, many of these methods were still in the test-tube stage or were too expensive.

Land disposal too was an uncertain choice. The Water Department and E.P.A. had planned to do a joint land disposal study on military land in Franklin County. This plan was dropped, however, in the spring of 1975 in deference to the wishes of Franklin County residents.

Now seeking new land, the two agencies will do a three-year study to determine the effect of sludge (and particularly sludge metals) on soil, plants, and underground water. The estimated cost of the study will be \$4,878,000. Because of opposition in some communities, land may be difficult to find.

Land disposal, including a 60-day preliminary study, will be included in a 10-point program which the Water Department is preparing. This program includes sludge dewatering to produce dry sludge, creation of a recycling center, study of disposal in strip mines, use of sludge for land fill, improvement of sludge digestion, and study of the "wet oxidation" and pyrolysis processes for cooking, incineration, or by-product conversion of sludge. The wet oxidation and pyrolysis studies alone will cost \$5.6 million.

The department also plans to give away some sludge to the public in 1976. This would be used as a soil conditioner on lawns and flower beds.

Improving Wastewater Collection

To improve the flow of sanitary wastes and storm water, the department made numerous changes in its collector system. This system of sewers, regulating chambers, and pumping stations collected flows from all parts of the city as well as from tie-in lines belonging to other communities.

Sanitary and Storm Sewers: For many years the department had been rejuvenating and extending its sewer network. Of the 2,830 miles of sewers in service, nearly one-quarter had been built since 1953.

This construction was unabated in 1973-75, as sewers were laid to serve new homes and industries, replace old

lines, or relieve storm flooding. Into these lines went durable materials that will meet public needs for decades.

1. Growing industrial parks got special attention. To service a park on Fenmore Road, the department built a short sanitary line and a long storm water conduit in Red Lion Road. The latter (five feet in diameter) will pick up storm flow at Fenmore Road and convey it for a half mile to Paul's Run. Both sewers, built at a cost of \$466,744, will be further extended under future contracts.

Improved service was also in sight for the expanding International Airport and the growing industries near it. Thus—

- The department built a large intercepting sewer in open cut along Tinicum Avenue and in tunnel under the Airport Circle. The 2,100-ft. sewer, built under a \$762,000 contract, will collect sanitary wastes from Eastwick and the airport area.

- Work was also moving ahead on huge sewers required by the relocation of the industrial highway (Essington Avenue) which runs by the airport. By June, 1976, the department will have completed three miles of storm water conduits, measuring up to seven feet in diameter, and a mile of sanitary sewers. The \$4 million job is being jointly financed by the federal, state, and city governments.

2. Several hundred miles of old brick sewers dating back to the 19th century posed a continuing challenge. Vibrations from overhead traffic, disintegrating mortar, and the stresses of age were causing numerous breaks. As a result, the Water Department was replacing three to five miles of sewers each year. The old bricks were replaced with reinforced concrete tubes or boxes.

Much of this work was done in old North Philadelphia neighborhoods which were being redeveloped. There—both east and west of Broad Street—the department replaced 9,000 feet of sewers under contracts totaling \$3,286,000. The Federal Government paid half of the cost.

Notable was the collapse in 1973 of a large intercepting sewer in Delaware Avenue between Shackamaxon and Sarah Streets. Beginning with a huge cavity, the ground subsided for 200 feet.

Set at a depth of 40 feet, the sewer required complex and difficult replacement measures. After emergency sheathing and shoring, the department replaced the brick line in 1975 with a new reinforced concrete box (6 ft. x 5 ft.) for a distance of 292 feet. It also cement mortar lined 140 feet of the remaining brick portion. To do the latter, flow was diverted to the river in December, with the permission of the Delaware River Basin Commission. The various contracts totaled \$1,035,000.

Also replaced were—

- 1,447 feet of the large Willow Street Sewer, between

Orianna and 5th Streets (\$1,401,425),

- 1.5 miles of sewers in Germantown Avenue (\$2,714,000).

3. To reduce storm flooding in the Olney and Logan sections, the department began to build a giant tunnel sewer beneath Nedro Avenue, from 6th Street to the Tacony Creek.

Because of difficult drilling and blasting through hard rock, the tunnel moved slowly in 1975. By the end of the year, however, the top half had been excavated for 2,000 feet.

Running at depths of 10 to 45 feet, the new conduit (when completed in mid-1977) will divert up to 1,200 cubic feet of storm water per second from the Rock Run Sewer System. The latter, which drains 1,842 acres in North Philadelphia, is frequently overloaded during heavy rains.

The new line will include 4,743 feet of 11-ft. diameter, concrete tube in tunnel, plus 380 feet of reinforced concrete box in open cut. The box will measure up to 11 ft. x 14 ft. in size.

Built under a \$5,026,000 contract, the tunnel sewer will bring initial flood relief to areas around 6th Street and Somerville Avenue. At a later date—under another contract—it may be extended north to Godfrey Avenue and then west to Broad Street. This would end flooding in the Godfrey Avenue area.

To bring relief from storm flooding, the department also—

- Enclosed and realigned a small stream near Geiger Road in Northeast Philadelphia (\$375,000),

- Built 3.1 miles of huge storm water conduits in Eastwick under contracts totaling \$3.6 million,

- Made a hydrological survey of the Manayunk Canal as a basis for future corrective measures,

- Laid plans for a new relief sewer in West Philadelphia. This conduit, which will be started in 1976, will reduce strain on the Thomas Run Sewer System by diverting storm water to another discharge point on Cobbs Creek. The 8,000-ft. line, up to 13 feet in diameter, will cost nearly \$6 million.

Regulating Chambers: Of special interest were plans for computer control of 180 regulating (or intercepting) chambers scattered throughout the sewer system. One purpose of this would be to reduce the pollution of rivers in time of storm.

The regulating chambers divert flow from "combined" sewers to wastewater plants in dry weather, but bypass a portion of the swollen flow to the rivers during heavy storms. Combined sewers carry both sanitary wastes and storm water in the same pipe.

To control such overflow, a small computer was installed at the Northeast Pollution Control Plant in the autumn of 1975. This computer will be linked eventually to electronic instruments in all the regulating chambers.

During heavy rains, the chamber instruments will transmit signals to the computer, indicating the height, volume and rate of flow, and the computer will send back a signal telling the chambers when to discharge flow to the rivers and how much to discharge.

In this way, it may be possible to retain some flows inside larger sewers during the storm and divert them to treatment plants afterwards.

Much work remains to be done, however, on this new system. Implementation covering all regulators, as well as the department's numerous rain gauges, will require up to seven years. In addition, a new type of regulator must be designed and installed in most chambers. As a start, the department will link 15 regulating chambers and a few rain gauges to the new computer in 1976.

Besides protecting the rivers, the new system will alert personnel to chamber malfunctions.



Our Historic Past: It is another historic moment for the old Cannonball House as a contractor delicately moves it to Fort Mifflin. The 1657 farm house, which withstood British shot during the War of Independence, was moved to provide space for expansion of the Southwest Plant.

Delaware Avenue Collapse: A large intercepting sewer collapsed in Delaware Avenue, and the Water Department replaced it for 292 feet.

The Pumping Stations: A Surge Basin

To safeguard a pumping station which lifts water from Mingo Creek into the Schuylkill River, a large surge basin will be built. This basin, which will be located north of Bartram Avenue between Essington and Mingo Avenues, will receive back up waters from Mingo Creek during storms.

Basin construction started in December, 1975, under a \$1,269,000 contract and will require one year to finish.

As a prelude to the basin work, the Water Department built a waterway opening beneath Mingo Avenue at Bartram Avenue in 1974. The opening, 106 feet wide x 80 feet long, consists of seven reinforced concrete cells. It also supports a large sanitary sewer. The cost of the opening was \$590,758.

Mingo Creek drains large portions of Eastwick and the International Airport area.

Because of previous modernization, there were few changes in the stations which pump sanitary wastes.

At the Neill Drive Station, the periodic interruptions caused by electrical problems disappeared. This resulted from the installation of new electrical switchgear and metering devices, as well as erection of a new building to house the equipment. The work was done under contracts totaling \$91,900.

Changes in a small underground station at Milnor Street southwest of Grant Avenue improved sanitary flow to the Northeast Plant. The changes, costing \$49,165, included the installation of new electrical equipment and a third pump.

In 1976, two old pumps will be replaced at the Central Schuylkill Station. Each new pump will raise 40 million gallons of wastewater daily from siphons that run under the Schuylkill River from the east bank to the west. Cost: \$320,000.

Improvements were made in 1975 to seven small

chambers which meter wastewater from outlying communities. Cost: \$179,000.

Sewer System Maintenance

Maintenance crews kept constant watch on the far flung collector system. Trudging through sewers, probing inlets, inspecting laterals, or cleaning drainage rights-of-way, they performed more jobs than in a number of years.

This activity was being increasingly mechanized as the Water Department acquired advanced pieces of equipment, and much of the related paper work was being done by computer.

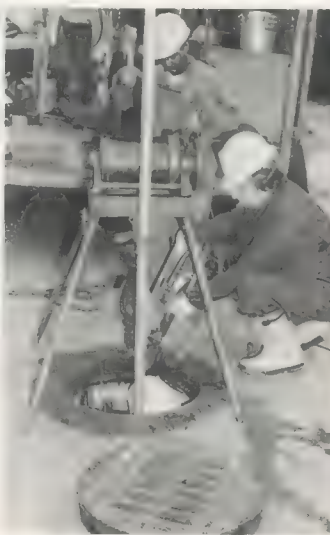
Sewer Maintenance: To keep the sewers flowing, the crews applied many an ounce of prevention. By television camera or on foot, they inspected 128 miles of main sewers and 79 miles of branch lines, from mid-1973 to mid-1975. These inspections were continuing in fiscal 1976. About 3.6 miles of sewers were listed for replacement.

This inspection was of growing importance, for the city had hundreds of miles of sewers that were 75 to 100 years old. Because of age, there were 102 sewer breaks in 1973-75, and the crews replaced 544 feet of line.

The crews also cleaned 82 miles of sewers by high-pressure water jet and five miles by mechanical bucket. They rodded over five miles of choked sewers and inlets, and cleaned more than 45 acres of streams and bordering banks.

Jobs performed by the crews on the inspection, repair, cleaning or reconstruction of various facilities included

Jobs	1973-74	1974-75
Sewers.....	8,072	9,405
Inlets (repairs only).....	13,234	12,030
Manholes.....	548	548
Laterals.....	26	42
Drainage Rights-of-Way.....	411	750
	<u>22,291</u>	<u>22,775</u>



For Efficient Sewers: Crews inspected 207 miles of sewers by walking, crawling, or hauling a television camera. They also cleaned sewers and installed a new type of locking nut on inlet covers.

Inlet Cleaning: Because of adequate personnel and equipment, the cleaning of sewer inlets was nearly current. At least one cleaning was given to each of the city's 75,000 inlets each year.

While maintaining a rigid cleaning schedule, the crews also responded to thousands of special inlet complaints. They removed old bottles, cans, paper, leaves, and other rubbish, thrown or swept into inlets by the public.

From the inlets, indeed, the crews were removing 1.7 million cubic yards of debris annually. This would have filled the playing field of Veterans' Stadium to a height of 50 feet.

Although some cleaning was still done manually, the department was constantly improving its automotive cleaning units. In 1975, it purchased six "combination" units with hydraulic crane and dump body, and a new vactor truck with vacuum cleaner and high-pressure water jet. Besides supporting vehicles, it now had 38 automotive cleaning units.

For the inlet crews, missing or stolen inlet covers were a bothersome problem. In fiscal 1974 the crews replaced 7,000 covers and in fiscal 1975 this number reached nearly 11,000. The cost of replacement of these expensive metal covers ran into thousands of dollars.

To meet this problem, the crews installed hundreds of locks on inlet covers. The City Council also passed an ordinance in 1974 making it illegal for any person to possess or sell manhole or inlet covers without the written authorization of the Water Commissioner. All local scrap metal dealers were notified of this.

By 1973 the department had computerized all of its inlet cleaning records, and a computer was regularly turning out eight different types of inlet reports. Because of this improved control—and better automotive equipment—the department planned to increase inlet cleanings to 100,000 annually in the future.

A New Headquarters: To make operations more efficient, the department will build a new headquarters for the Sewer Maintenance and Inlet Cleaning Sections. Spread over 5.9 acres, this will be a two-story brick building (100 ft. x 80 ft.) that will include staff offices and an assembly room for field crews. There will also be prefabricated buildings for storage, maintenance, and vehicle protection. The cost of the new headquarters, including 250 parking spaces, will be \$1.8 million.

The new headquarters will locate Sewer Maintenance and Inlet Cleaning conveniently close to other maintenance units at 29th and Cambria Streets. It will replace inadequate, and sometimes distant, facilities.

In 1975 some improvements were made to a Sewer Maintenance building at Lardner's Point. These included general construction, plumbing, heating, and electrical work under contracts totaling \$148,500.

Automating the Control of Industrial Wastes

With a control program that was 30 years old, the Water Department was successfully curbing many harmful industrial wastes.

To keep these wastes out of streams and sewers, its sanitary engineers made hundreds of visits to local industries. In the course of such visits, the engineers investigated pollution complaints, inspected devices for waste recapture, and advised industrial management on how to bottle up or neutralize wastes more efficiently. Many industries asked for consultations.

In 1973-75, sanitary engineers provided more than 2,000 inspections and consultations. As a result, many industries installed new control devices and some of them achieved important savings through the recapture and reuse of wastes.

For some industries there was an additional spur. They found it desirable to recover wastes because of a special surcharge imposed by the city on wastes above a certain strength.

To enforce this surcharge, the department's inspectors collected more than a thousand waste samples from a variety of industries. These samples were tested at the Northeast Plant laboratory, and the results sent to a computer for print-out.

Some of this sampling was being done by automatic samplers, which take portions of flow every five or 10 minutes. Affected industries will be required to install sampling chambers in the future for more efficient use of the sampling devices. The department also plans to monitor some effluents continuously by having automatic samplers send signals to a computer at the Northeast Plant.

As a result of this sampling, the Water Department collected \$2.1 million in surcharge revenues in fiscal 1973-75.

To prevent stream pollution, sanitary engineers investigated several hundred public complaints. These included odors from sewers and rivers, sewer blockages, oil and chemical spills, contaminated storm sewers, and illegal tank truck operations.

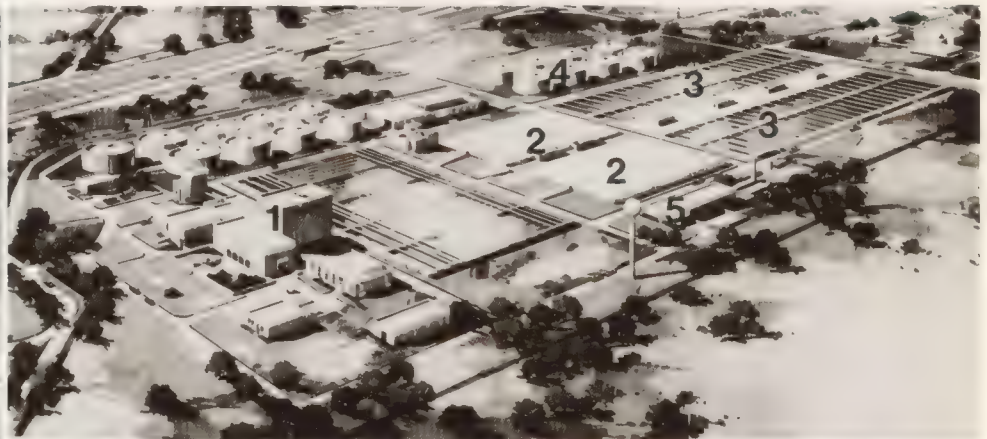
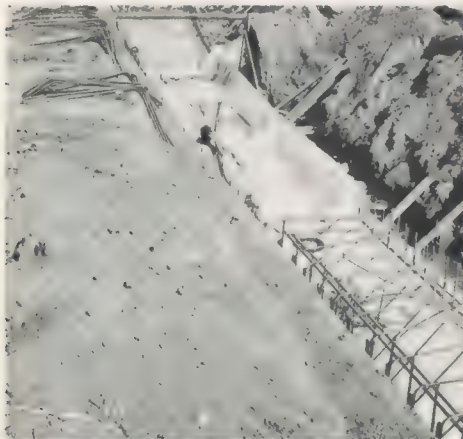
Oil spills into the rivers were receiving increasing attention. To clean up such spills, the department acquired a variety of equipment, including a boom, skimmer pumps, small motor boat, absorbents, and a portable oil interceptor.

To meet federal requirements, the department made extensive surveys of the industrial sources of toxic wastes and heavy metals. Its automatic sampling program was also intended to anticipate a federal plan for future user charges on industry and for apportionment to industry of some part of the capital cost of municipal wastewater plant expansion.

New wastewater plants will protect streams



Ground Breaking: Mayor Frank L. Rizzo begins a \$414 million expansion of the city's three water pollution control plants by scooping up the first earth at the Southwest Plant.



New Facilities for Southwest Plant

Southwest Expansion: As part of preliminary work, contractors build a box-type conduit, which will carry plant effluent to the Delaware River. The work also includes concrete tubes beneath busy Enterprise Avenue.

- | | |
|------------------------------|-------------------------------------|
| 1. Pre-treatment building | 5. Oxygen compressor building |
| 2. Oxygenation tanks | 6. Pumping station and chlorination |
| 3. Final settling tanks | 7. Administration-computer |
| 4. Additional digester tanks | |

SEWER INVENTORY

As of June 30, 1975

Branch Sewers Are < 4' Diameter—Main Sewers Are > 4' Diameter

Material	SEPARATE SYSTEM (1,136.14 MILES)			Stormwater [Main]
	Sanitary	Stormwater [Branch]		
C.I. Pipe	2.86 mi.	0.67 mi.		
Vit. Pipe	545.40 mi.	28.36 mi.		
R.C. Pipe	0.81 mi.	389.46 mi.		24.87 mi.
Brick	1.98 mi.	102.12 mi.		11.32 mi.
C.M.P.		0.99 mi.		0.38 mi.
Rect. R.C.				26.92 mi.
Total	551.05 mi.	521.60 mi.		63.49 mi.

Material	COMBINED SYSTEM (1609.94 MILES)				Outfall
	Branch	Main	Relief		
C.I. Pipe	2.84 mi.				0.21 mi.
Vit. Pipe	151.64 mi.				
R.C. Pipe	217.33 mi.	32.53 mi.	7.22 mi.		4.61 mi.
Brick	1024.94 mi.	112.53 mi.			6.74 mi.
Wooden					0.30 mi.
Rect. R.C.		39.25 mi.	1.76 mi.		8.04 mi.
Total	1396.75 mi.	184.31 mi.	8.98 mi.		19.90 mi.

Material	INTERCEPTING SEWERS		MANHOLES	
	Branch	Main		
C.I. Pipe	7.30 mi.	0.51 mi.	Sanitary	13,278
Vit. Pipe	40.08 mi.		Stormwater	12,801
R.C. Pipe	25.25 mi.	17.59 mi.	Special	2,085
Brick	11.03 mi.	10.61 mi.	Drop	215
Rect. R.C.		20.20 mi.	Wellhole	1,298
Total	83.66 mi.	48.91 mi.	Combination	49,461
			Inter.	2,468
			Total	81,606

Total Miles Inter. Sewers	132.38
Total Miles of Branch Sewers	2557.23
Total Miles of Main Sewers	321.42
Total Miles of Sewers	2878.65

CHAMBERS	
Intercepting	99
Slot	77
Separating	25
Junction	71



Tunnel Sewer: To relieve flooding in North Philadelphia, workers were cutting a mile long tunnel under Nedro Avenue. The concrete-lined tunnel will divert storm water from the overtaxed Rock Run Sewer.

Paper Work, Paper Work: Piles of books represent just one of the scores of contracts that will be required to expand the city's wastewater plants and phase out ocean disposal. Not shown are piles of reports required by federal and state agencies.

Pumping: To improve pumping of sanitary flow at the Neill Drive Station, power lines were laid for a new switchgear building.

WATER POLLUTION CONTROL PLANTS: OPERATING DATA

	Fiscal 1973-74			T—Total * Weighted Average	Fiscal 1974-75			T—Total * Weighted Average
	Northeast	Southeast	Southwest		Northeast	Southeast	Southwest	
Population equivalent**	1,907,900	929,000	883,700	T—3,720,600	1,492,000	868,000	697,000	T—3,057,000
Wastewater Flow (in millions of gallons daily)								
Rated plant capacity.....	175	136	136	T—447	175	136	136	T—447
Total flow treated.....	195.43	120.62	147.64	T—463.69	188.94	118.79	156.05	T—463.78
Flow from other communities.....	14.76	3.17	28.57	T—46.5	15.12	2.85	27.61	T—45.58
Solids in Wastewater (in parts per million)								
Raw suspended solids.....	262	186	216	*288	227	240	216	*227
Final suspended solids.....	78	83	106	*88	74	75	99	*83
Total solids removed.....	184	103	110	*139	153	165	117	*144
% of solids removed.....	70	55	51	*60	67	69	54	*63
Tons of solids removed daily	153	52	68	T—273	121	82	76	T—279
Biochemical Oxygen Demand in Wastewater (in parts per million)								
Raw wastewater B.O.D.....	199	157	122	*163	161	149	91	*134
Final effluent B.O.D.....	72	101	72	*80	57	90	61	*67
Total B.O.D. removed.....	127	56	50	*84	104	59	30	*67
% of B.O.D. removed.....	64	36	41	*49	65	40	33	*50
Lbs. of B.O.D. to river.....	117,400	101,600	88,700	T—307,700	89,800	89,200	79,400	T—258,400
Gas Production Millions of cubic feet daily.....	0.958	—	0.958	T—1.916	0.809	—	0.860	T—1.669
Cubic feet per lb. volatile.....	6.4	—	6.5	*6.5	6.1	—	8.5	*7.3
Electric Power Cost Cost per million gallons pumped.....	\$2.53	\$3.40	\$3.68		\$3.62	\$4.44	\$6.01	
Digested Sludge Gallons barged to sea.....	61,697,989	—	61,475,105	T—123,173,094	89,107,560	—	66,424,440	T—155,532,000
Average % of solids	13.1	—	6.6	*9.9	13.7	—	5.8	*10.3

**POPULATION EQUIVALENT IS NOT ACTUAL POPULATION. It is a technical measure of wastewater strength. It is figured as 0.167 lbs. per person daily.

Wastewater Figures by Calendar Year

		1974	1975
Northeast Plant:	Flow treated daily—M.G.D.	191.4	193.9
	% of solids removed	70	66
	% of B.O.D. removed	65	64
Southeast Plant:	Flow treated daily—M.G.D.	114.6	118.7
	% of solids removed	60	59
	% of B.O.D. removed	33	50
Southwest Plant:	Flow treated daily—M.G.D.	151	164.3
	% of solids removed	48	55
	% of B.O.D. removed	35	32

Management Services

Tightening Management to Save \$6 Million

Savings and increased efficiency were two constant goals of management. These goals were reflected, in part, in the successful efforts to limit personnel and overtime.

While the number of government employees was rising (over the long term) in many communities, the Water Department continued a "hold the line" policy. This policy had kept personnel strength within a narrow range for 18 years.

Thus on January 1, 1958 the department had 1,663 permanent, full-time employees. This peak was never reached again, and by December 31, 1975 the number had fallen to 1,519.

This modest, long-term decline had been achieved despite constantly improving service to the public.

New water plants, microwave controls, incentive pay, computerized procedures and other improvements had eliminated many jobs, but these had been partially offset by expanded inlet cleaning, rat control, and other services.

Overtime Reductions: In line with City Administration policy, the department continued to reduce overtime. The rate of overtime spending, indeed, fell for the third and fourth consecutive years. Measured against the total salary base of the department, overtime had declined by 3.1 percentage points since fiscal 1971.

Fiscal Year	Percent of Overtime to Base
1970-71	15.3
1971-72	13.7
1972-73	13.0
1973-74	12.8
1974-75	12.2

By the close of calendar 1975, the accumulated value of overtime saved was \$1.5 million.

Study Savings: Other large savings were being made as a result of a manpower study concluded in fiscal 1972. This study had provided for new administrative and work procedures, and had eliminated numerous jobs. By December 31, 1975, the accumulated savings had reached \$4.7 million.

The department extended these studies in 1973-75 to management practices and methods. As a result, new procedural improvements were made in eight operating divisions.

The small Management Study Unit also examined organization and staffing, plant custodial work, the leave balances program, supervisory training, meter handling, keypunching, and unaccounted for water.

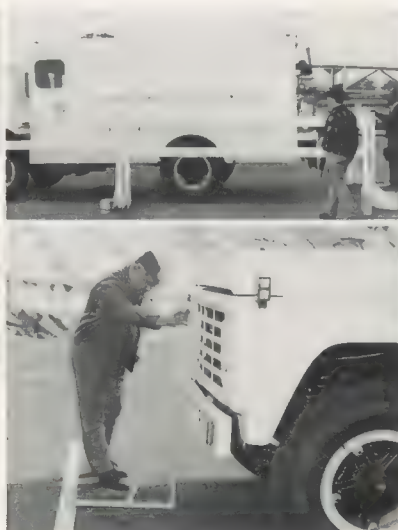
In late 1975 the Water Department requested the City Controller's Office and the Rudolph Palitz Company, consultants, to suggest improvements in its operations. This study will continue in 1976.

New Manual: As an aid to public officials and citizens, the department issued in October, 1975, its first printed manual of rules and regulations governing water and sewer service. The manual, edited by Samuel J. Schwartz, resulted from a decade of reviewing and updating scores of Water Department regulations. Copies were issued free to the public.

Personnel Developments

To help its employees cope with an age of sophisticated plants and computers, the department provided varied—and sometimes original—training.

- Thus the department paid part or all of the tuition for certain college courses taken by a dozen engineers and



For Improved Safety: Eight Water Department units in 1974 and seven in 1975 won awards from the Chamber of Commerce (on behalf of the National Safety Council) for reducing their disabling injury rate.

Road-eo: Equipment operators show their skill in this 1974 "road-eo", as they park, maneuver, and run obstacle courses to win prizes put up by Water Department Local 394. The successful road-eo was repeated in 1975.

technicians yearly. These courses were related to present or future employee responsibilities.

- Twenty-four managers from top and middle ranks attended an executive development seminar, financed by the Federal Government.

- As in past years, many employees pursued technical courses offered by industries or special schools. Other employees attended an on-the-job course for treatment plant operators.

- Greeted with enthusiasm by older employees was a pre-retirement class, conducted by expert counselors. Eighty senior employees, plus some wives, attended this class in 1975. Intended to smooth the transition to retirement, the class is unique among City departments.

- Orientation sessions, as well as telephone-interview instructions, were provided for 292 employees.

Recruitment: To fill vacancies left by retiring older engineers, the department's representatives visited many East Coast colleges. They interviewed 282 engineering seniors, and the department eventually hired 37 as graduate engineers.

Departmental personnel increased somewhat in fiscal 1974 but declined the following year. Sick leave use also fell slightly.

Personnel statistics for three fiscal years, covering permanent, full-time employees, were as follows:

	1972-73	1973-74	1974-75
Total on Rolls (June 30)	1,571	1,619	1,588
New Appointments.....	117	208	147
Separations	188	234	237
Promotions.....	124	79	107
Turnover Rate	11.3%	11%	9.28%
Days of Sick Leave Use Per Employee	13.1	13.15	12.98
Total Sick Days Used	22,991	21,115	20,412

By the close of 1975, the department had computerized all of its personnel records. In 1976 this will provide periodic and rapid analyses or tallies of attendance, vacation, sick leave, compensatory time, and other data for all employees.

Gifts: As they had done so often in the past, Water Department employees contributed generously to community causes. Their contributions included:

	United Fund	Catholic Charities	United Negro College Fund
1973-74	\$57,196	\$10,593	\$3,664
1974-75	59,772	11,123	3,981
1975-76	71,639	(In United Fund)	3,214

The department became a United Fund Torchlighter each year. In the autumn of 1975, more than 80% of its employees gave to the fund.

A Better Safety Record

In one respect, the department's safety record improved sharply in fiscal 1975. The number of disabling injuries per million man hours worked was 27.9—a drop of 14.9 from the previous year.

Actual work days lost because of injury also declined, from 1,380 to 846, and total disabling injuries slid from 130 to 99. Minor medical treatment cases, however, rose slightly from 145 to 155.

The change in the disabling injury rate took place gradually, as the department strengthened its safety education program. Each month it emphasized a different safety theme, including city driving, safety equipment, seat belts, safe lifting, etc.

There were safety talks, slide presentations, news letters, posters, and meetings at job sites, as supervisors tried to reduce costs and loss of time by reducing accidents.

To reduce motor accidents, over 400 employees were



Employee Recreation: Many sports contests were sponsored by the Water Department Employees' Recreation Association. Team representative receives trophy.

Driver Safety: Equipment operators proudly hold certificates earned in safe driver courses. Operators demonstrated a variety of "good driver" skills.

Torchlighter Award: For the fourth year Water Department employees surpassed goals for giving to the United Fund. The department won "torchlighter" status each year.

given defensive driving courses. These included supervisors as well as line employees who operate City vehicles.

The picture of motor accidents, however, was somewhat mixed, with preventable accidents numbering 100 in fiscal 1974 and 144 the following year. Unpreventable accidents—48 in 1974—barely changed a year later.*

Despite this, the National Safety Council bestowed 411 "safe driver" awards on Water Department employees. The awards were for driving a municipal vehicle for an entire year without a preventable accident.

Eight departmental sections in 1974, and seven in 1975, received awards from the Chamber of Commerce of Greater Philadelphia (on behalf of the National Safety Council) for maintaining a low frequency rate for disabling accidents.

Customer Service—24 Hours Daily

Citizens with water or sewer problems turned frequently to the Customer Service Section. They reported flooded cellars, clogged inlets, broken mains, leaking sewers, low water pressures, open fire hydrants, and many other emergencies. They telephoned on the average 155,000 times a year.

In response to these calls, Customer Service inspectors made thousands of on-the-spot investigations. In many instances, crews were dispatched to pump out cellars, clear inlets, repair pipes, close hydrants, or provide other remedies.

Customer Service personnel made 95,000 inspections yearly. These covered permits, billings, settlement readings, missing meters, charity applications, and water quality.

In 1973-75, nearly 22,000 notices, citing drainage or other violations, were issued to property owners. In most instances, owners corrected the cited condition, and only 143 cases were taken to court.

Many customers on welfare, however, were unable to pay for plumbers. In these cases, the department made the correction and billed the customer in installments. There were 535 such cases in 1973-75, and the cost of the related work was nearly \$159,000.

As administrator of a small claims ordinance, the Water Department (through its Customer Service Section) settled 30 claims at a cost of \$4,594 in fiscal 1974, and 74 claims for \$31,537 the ensuing year. These were

claims for property damage caused by broken water mains and sewers, or by other drainage conditions.

Informing the Public

Conscious of the right of its customers to know, the Water Department used many means to "tell its story."

It distributed thousands of brochures, published a high-quality biennial report, issued news releases, participated in television and radio interviews, arranged for exhibits, built parade floats, and freely answered requests from its customers for information.

As they had done in past years, the department's plants maintained a daily "open house" to the public. Over 19,000 visitors toured the water treatment plants, and 1,700 the water pollution control plants, from July 1, 1973 to December 31, 1975. These included many officials and engineers from abroad.

Notable was the summer shower program for children. Because of the growing abuse of fire hydrants, the Water Department gave this program new impetus in the summers of 1974 and 1975. Working through neighborhood police stations, it distributed 2,500 plastic sprinkler caps each summer. These caps, designed by the Water Distribution Section, reduced water waste from 1,000 to 78 gallons a minute when attached to fire hydrants.

The new caps, which were free, were promoted through the news media and other outlets.

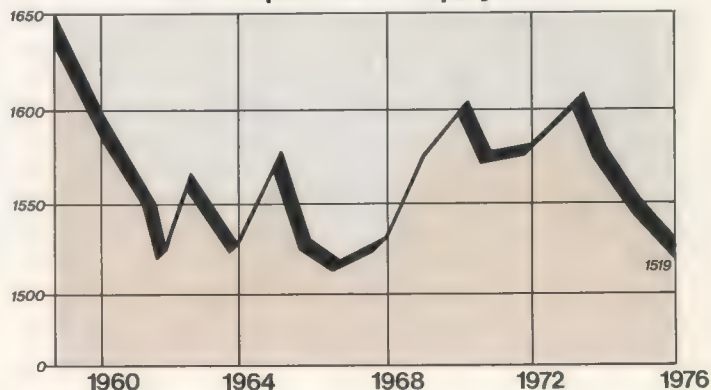
The City Council reinforced this campaign in July, 1975, by passing an ordinance imposing fines of \$50 to \$300 for the illegal opening of fire hydrants.

The Water Department received the "1975 Professional Engineers in Government Award" from the Pennsylvania Society of Professional Engineers. The award cited the department for low engineer turnover, numerous engineer training programs, over 200 memberships in engineering societies, and the production of numerous technical papers that advance engineering knowledge.

*Some calendar year figures on accidents:

	1974	1975
Disabling injuries.....	112	108
Medical treatment.....	142	147
Preventable motor.....	87	97
Unpreventable motor.....	39	55

Number of permanent
Water Department employees.



Personnel Changes

The most important personnel changes during the two fiscal years included the following:

Promotions

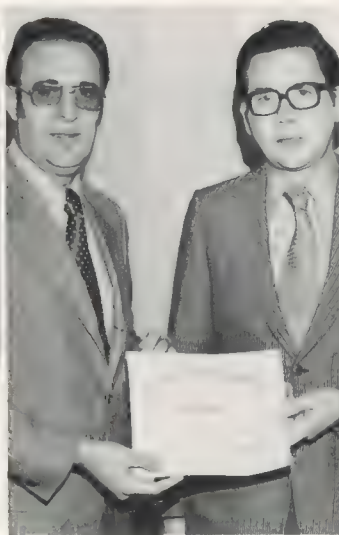
In fiscal 1974: Joseph Radziul (Chief of Research and Development), from Administrative Engineer I to II; William Wankoff (Superintendent of Wastewater Treatment), from Sanitary Engineer II to III; Martin Lozanoff, from Chemist II to Supervisor of Water Pollution Control Laboratory; Peter D'Amelio, from Instrumentation Technician II to Instrumentation Supervisor; Henry Horne, from Foreman to Supervisor of Automotive Maintenance.

In fiscal 1975: Michael Nelson (Chief of Water Pollution Control), from Sanitary Engineer III to V; Alan Hess (Chief of Water Treatment), Sanitary Engineer IV to V; William Ross, from Civil Engineer II to Sanitary Engineer III; Bruce Aptowicz, John Spitko, and Patrick Cairo, from Sanitary Engineer II to III; Philip Downs, from Civil Engineer II to Staff Engineer I; Andrew Peters, from Electrical Engineer II to Staff Engineer II; Julius Mudry, from Civil Engineer III to Engineering Supervisor II; Richard Grochowski, from Chemist II to III; and Samuel Counter, from Security Officer II to III.

Retirements

In fiscal 1974: Samuel Kolbhoff, Engineering Supervisor II (Assistant Chief of the Design Branch), on December 31, 1973; Edward Braudy, Engineering Supervisor I, on August 24, 1973; James DeFrisco, Engineering Supervisor I, on July 22, 1973; Charles Mager, Civil Engineer II, on July 23, 1973; Ernest Hatton, Civil Engineer II, on July 22, 1973; William Snyder, Automotive Maintenance Supervisor, on July 22, 1973.

In fiscal 1975: Paul Hartman, Utility Rate Analyst, on January 10, 1975; George Carpenter (Chief of Wastewater Treatment), on January 21, 1975; Alexander Tatarskyj, Engineering Supervisor I, on October 18, 1974; Louis Benoff, Engineering Supervisor I, on September 3, 1974; and Joseph Thompson, Civil Engineer II, on January 24, 1975.



'Tis the Season to Be Jolly: Water Department employees repeated a custom of long standing. They sang carols at Christmas in City Hall courtyard, as the public listened.

Graduate: Many Water Department employees improved their skills by attending the Philadelphia Government Training Institute. Timothy Waterman (left) receives a certificate of course completion from Commissioner Carmen F. Guarino.

Engineering Services

Research and Planning—A Growing Activity

"Thinking ahead" had become a normal way of life for Water Department engineers. Faced with the problems of an environmentally conscious age, they were under constant pressure to plan, to do research, and to develop new solutions.

Engineers at all levels, and in all sections, of the department were involved in this ongoing policy... designed to improve the city's water and clean up its streams.

Many new ideas, however, were being created by a special Research and Development Unit. R. and D. engineers made or coordinated studies of water plant automation, rainfall patterns, sewer inlet design, creek pollution, storm water overflow, sewer infiltration, river quality, and links to a space satellite. Many of these studies required the development of sophisticated instrumentation.

Important research was also being done by staff engineers of the Water Pollution Control Division. These engineers explored a variety of environmental questions, ranging from ocean disposal and its alternatives to federal requirements for sewage treatment.

In furtherance of its goals, the department participated in federal, state, and regional committees engaged in comprehensive planning.

A New Computer to Aid Research

Much of the department's brainstorming was being done on its engineering computer. Operated by R. and D.'s Engineering Center, the computer was becoming increasingly popular. In the two most recent years, its use had grown by 786 hours.

Total hours included:

	Water Department	16 Other City Agencies
1972-73	1,680	924
1973-74	2,139	916
1974-75	2,073	1,317

Thanks to the computer, the engineering units were saving time and money on planning and design. The computer turned out a variety of complex graphs, tables, calculations, and reports, that would have been too time consuming if done by engineers.

Operating units also benefited... from a steady stream of computerized data on plant operations, chemical usage, inlet cleanings, sewage flows, and industrial wastes.

Noteworthy in 1973-75 was the development by the department of the first computerized system in the United States for storing, retrieving, and analyzing data on water quality. Great quantities of statistics were stored for this purpose.

The Engineering Center also refined new reporting systems for wastewater data telemetered from the Northeast Plant. A telemeter receiver was installed at the center.

Although engineering units were its biggest users, the computer produced an increasing number of administrative reports. New reports, based on newly written programs, covered incentive pay, keypunch requirements, personal services expenditures, attendance trends, labor cost data, and cash flow projections for plant expansion.

New Computer: Because of increasing demand for computer service, the department decided to replace its 1130 IBM computer with a later, faster, more capacious, and more flexible model. The new computer—Hewlett Packard 3000—was delivered in October, 1975.



Top Award: The Pennsylvania Society of Professional Engineers cited the Water Department for "outstanding contributions" to engineering. Department officials hold 1975 award.

Visitors from Abroad: Numerous engineers and officials from other countries visited the city's water and wastewater plants. This group from Italy was taken on a tour of the Delaware River, after seeing a new method of wastewater treatment.

At the Drawingboard: Keeping records of pipelines up to date was an unending job. Engineers revised thousands of block plans, plats and drawings.

The HP 3000 will be able to handle up to 64,000 words, or four times the capacity of the old computer, at any given time. Its speeds will be five to nine times greater.

In addition, there will be secondary storage of 54.5 million words, compared with 1.5 million words in the previous system. Printing speed will rise from 600 lines per minute to 1,250 lines, and the time required to change discs will be cut from four minutes to 45 seconds for any single change.

The new computer will also be able to (1) run several programs at the same time, (2) operate overnight without personnel in attendance, (3) communicate directly with field employees desiring to query it for information, and (4) receive data from stream monitoring stations via space satellite or land relay.

Under a special arrangement, the Water Department will buy the new computer on an installment plan spread over four years. Operating savings are expected to repay the \$309,000 cost by an early date.

During 1974, the department's Machine Records Unit was transferred organizationally (though not by location) into the Engineering Computer Center, and it was renamed the Operations Service Unit. This merger will ensure more efficient coordination between tabulating machines and computer.

The Engineering Units

The Design and Construction Branches used the computer for hundreds of hours each year. They rewrote or expanded a number of computer programs.

Design Branch: Some of these programs aided the Design Branch in planning for expansion of the water pollution control plants. Thus in 1975, Design engineers completed 17 contracts for new facilities at the Northeast Plant. Design personnel also assisted a private consulting firm (Greeley and Hansen) in preparing preliminary and final plans for the expansion of the Southwest Plant.

In addition, the Design Branch prepared "plans, specifications, and estimates" (in fiscal 1973-75) for 237 contracts with a value of \$33.3 million. These included 33 miles of water mains, 15 miles of sanitary and small storm sewers, a giant tunnel sewer to relieve flooding, and various improvements to water treatment plants, reservoirs, and other facilities.

Design also continued two major studies to determine whether the city will have adequate sewer capacity for the future. These studies included 132 miles of intercepting sewers and 83 miles of large storm water lines and outfalls.

Studies of drainage and water supply were also made to meet the future needs of commercial, industrial, and housing developments. Extending into neighborhoods all over the city, these studies included Market Street East, the airport high speed line, center city commuter rail connection, Penn's Landing, Eastwick, Franklinton, and the Schuylkill River Park.

Design engineers cooperated with federal and state officials on plans for drainage and pipeline changes required by the Delaware Expressway and other state highways within the city.

Construction Branch: Construction personnel took to the air for the first time to do surveying. They also acquired new electronic instruments to measure surface distances. These developments increased the accuracy of surveys, and saved time or manpower.

Engineers also supervised field construction under several hundred contracts. The value of these contracts dropped from \$38 million in fiscal 1973 to \$22.8 million in fiscal 1974, but rose to \$34.3 million the following year. On December 31, 1975, the department had \$83.8 million of contracts under construction or about to start.

In 1973-75, Construction's survey unit completed over 300 surveys and 200 plans for future construction projects.



This Too Is History: At the turn of the century, city engineers used this complex revolving slide rule, which now reposes in the Water Department library. Today even a later simplified version has given way to small transistorized computers.

Drainage Information Section: Inadequate record keeping by past generations had thrown much doubt on tallies of sewer mileages. To correct this shortcoming, Drainage Information personnel (assisted by the Construction Branch) spent 4,000 man hours on a comprehensive inventory. They examined and measured old plans in great detail.

By January 1, 1974, the Drainage Unit had completed an accurate tally of sewers by type, size, and mileage. The final sewer total, as of January 1, was 324 miles more than had previously been estimated. This tally has been kept up to date since then (see table entitled "Sewer Inventory" on page 36).

Drainage personnel processed over 2,200 applications for sewer connection permits (in fiscal 1973-75), and followed these up with field inspections. They reviewed hundreds of plans submitted by engineers and contractors, redrew several hundred sewer plans and drainage plats, and satisfied many public requests for information.

Water Main Records Section: In the same period, the Water Main Records Unit revised more than 6,000 block plans, plats, reports, and drawings related to the distribution system. It also processed 3,000 fire hydrant permits for businesses, charities, and clean block committees, and more than 300 service connection permits. Much assistance was given to outside architects, engineers, and plumbers seeking information.

Both the Water Main Records and Drainage Information Sections processed hundreds of applications received under a new state law (Act 287). This requires contractors to notify utility companies before digging up streets, and the utility companies to provide contractors with the locations of utility lines.

Materials Laboratory: 143,000 Tests in 1975

Spurred in part by the 1976 Bicentennial, many public projects were under way in Philadelphia. Supporting

these projects was the small Materials Testing Laboratory.

The laboratory, which is operated by the Water Department on behalf of all City agencies, was busier than it had been in many years. In fiscal 1975, it tested materials for 86 construction jobs.

These jobs included streets, bridges, libraries, airport expansion, a Fire Department headquarters, the new West Plaza of City Hall, a Mummers Museum, a new Robin Hood Dell for concerts, subway and fire stations, and numerous Water Department projects.

Into the laboratory poured 8,216 samples in fiscal 1975, compared with 4,780 the year before. Tests climbed from 87,841 to 143,728. Both physical and chemical tests increased.

The samples, which represented purchases by the City as well as materials used by contractors, included coal, oil, grease, gasoline, solvents, asphalt, textiles, paints, soaps, detergents, paper, wood products, chemicals, sand, soil, metals, concrete, and many more.

In fiscal 1975, 87% of chemical samples came from the Water Department, while the Streets, Commerce, and Public Property Departments provided 84% of physical samples. These proportions were little changed from the year before.

On these samples, the laboratory performed a variety of testing, ranging from "wet chemical" analysis to use of electronic instrumentation, and from heavy physical compression to centrifugal separation. Because of the city-wide construction, the laboratory bought two new instruments to test concrete structures on site.

To assure the City full value from vendors and contractors, the laboratory checked all samples against national standards developed by recognized professional organizations. Its personnel also visited factories to inspect the processing of steel pipe, valves, concrete products, and iron castings, before delivery.

Testing will increase in 1976 as the Water Department expands its water pollution control plants.

Construction Contracts—1973-75

Based on partial and final estimates in the field, the Water Department performed construction valued at \$28.7 million in the fiscal biennium from July 1, 1973 to June 30, 1975.

Water System

This work included \$3.7 million for water plants, pumping stations, and reservoirs, and \$3.3 million under water main contracts. In addition, an undetermined amount of work (probably in excess of \$1.3 million) was done on water mains under sewer contracts.

Other water system statistics: 112 contracts, with a limit of \$6.6 million, were completed; 112 contracts, with a limit of \$7.6 million, were awarded; and 68 contracts, with a limit of \$6.8 million, were in force on June 30, 1975.

Wastewater System

Physical improvements made at water pollution control plants were valued at \$3.4 million, while construction performed under sewer contracts totaled \$18.4 million. The latter included some water main work, noted above.

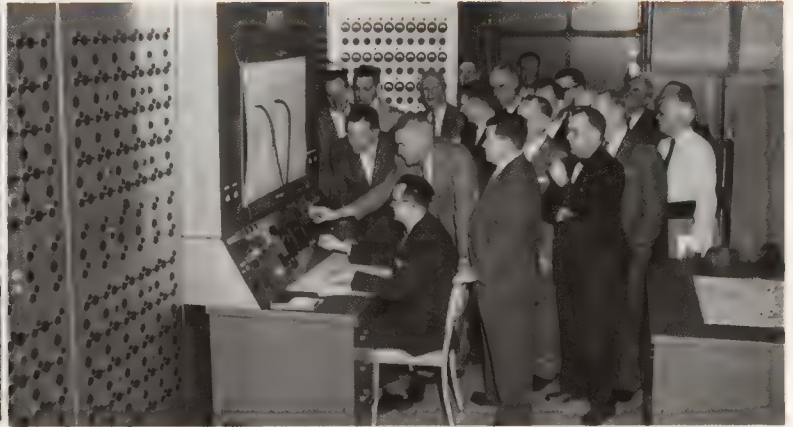
Other wastewater system statistics: 128 contracts, with a limit of \$18 million, were completed; 72 contracts, with a limit of \$41.4 million, were awarded; and 92 contracts, with a limit of \$27.5 million, were in force on June 30, 1975.

Our Historic Past

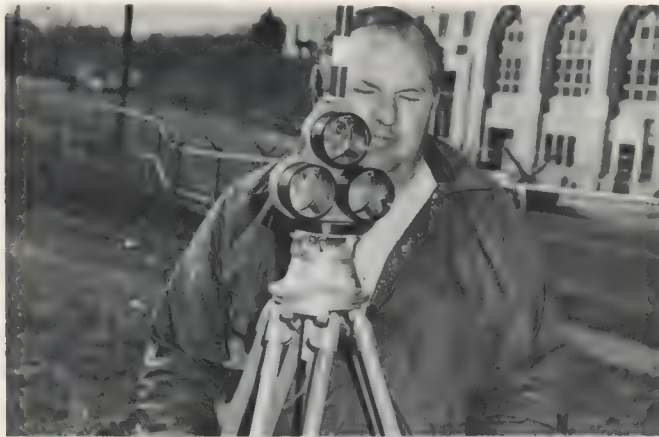
Times have changed in engineering



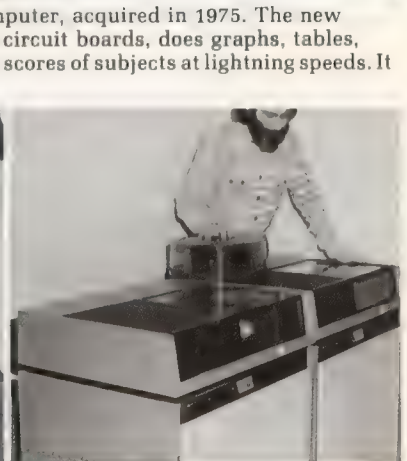
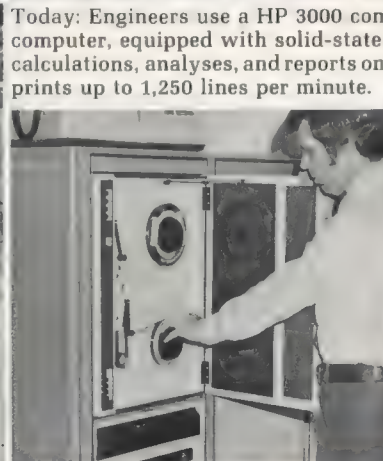
In Days of Yore: Surveyors used a sighting instrument and calibrated rod to survey lines for water mains, sewers, and other city projects. Distinguished group posed for this photograph in 1903.



Back in the 1950's: The solution to many difficult problems in water flow was speeded up by the department's network fluid analyzer, sometimes called an analogue computer.



Today: Engineers use a HP 3000 computer, acquired in 1975. The new computer, equipped with solid-state circuit boards, does graphs, tables, calculations, analyses, and reports on scores of subjects at lightning speeds. It prints up to 1,250 lines per minute.



Computer storage: An employee adjusts the magnetic tape driver, which provides continuing programs for the new computer. The memory (right) stores up to 94 million characters.

Today: New electronic instruments acquired by the Water Department Survey Unit in 1974 save time and manpower. They also make accuracy easier.

Fiscal Developments

An Increase in Charity Rates

For the first time the city's special "charity" rates for water and sewer service were increased.

This change was long overdue. The special water rate had been in effect since 1878, and the related sewer rate since 1946, with imperceptible adjustments..

On July 1, 1974, a new regulation (No. 49) went into effect, raising the rates paid by hospitals, colleges, universities, and the Philadelphia Housing Authority. Other "charity" customers, such as museums, old-age homes, public and parochial schools, and churches were unaffected.

The rising cost of services had forced the new increase, and there was need for more equitable levies on large institutions. Though often endowed with large financial resources, many institutions were paying only 2% of the rates normally paid by non-charity customers.

To bring institutional rates closer to the regular rates, the new regulation provided that—

- The Housing Authority would pay 75% of the rates charged regular customers with similar size water meters, starting July 1, 1974,

- Hospitals, colleges, and universities would pay 25% of regular rates for similar size water meters starting July 1, 1974, with an increase to 50% in the second year, and 75% from the third year onward.

Other charity customers will continue to pay only six cents per 1,000 cubic feet for water, plus the related sewer charge, which averages between four and six cents.

The new rates will increase revenues received by the Water and Sewer Funds.

Other Increases in Charges: Because of increasing

costs, water customers were asked to pay more for other services. The Water Department issued a number of new regulations, increasing the charges for ferrule and valve connections, laying of water service pipe, installation of water meters, certain uses of fire hydrants, and restoration of water service.

Special Rates for Senior Citizens

To help senior citizens meet the rising cost of living, the City Administration supported an ordinance which reduced certain water and sewer charges. The ordinance, which was passed by the City Council and became effective January 1, 1974, permits a 20% reduction in the "minimum" charge for water and sewer service.

Either husband or wife may qualify for this reduction, if either is at least 65 years of age and pays a water-sewer bill.

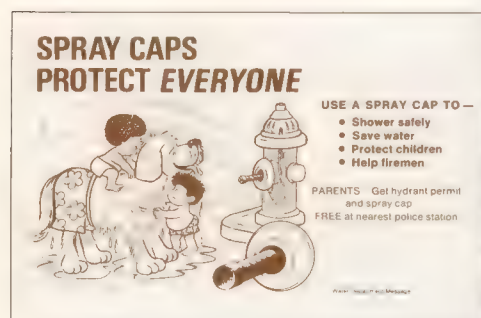
The new arrangement benefits senior home owners, but only those tenants who pay their own water-sewer bills.

First Sales of New Revenue Bonds

To finance capital costs for the construction of water and sewer facilities, the municipality sold water and sewer revenue bonds for the first time. These replaced the city's general obligation bonds for such financing.

Because of the Water Department's sound financial status, the \$75 million of revenue bonds were sold at an average effective interest rate of 6.968% in May, 1974.

Unfortunately, the shaky financial condition of New York City affected the municipal bond market in 1975. As a result, a new revenue bond issue of \$50 million for water-sewer construction was sold by Philadelphia at an average effective interest rate of 8.917% in September, 1975.



Safer Fun for Children: Ads like this helped to promote wider use of spray caps on fire hydrants. Spray caps cut water waste from 1,000 to 78 gallons a minute, and helped to preserve water pressures for homes.

Exhibits: The Water Department called attention to its customer service with this parade float. It was one of various exhibits that publicized department programs from time to time.

WATER DEPARTMENT MODERNIZATION

January 1, 1946 to June 30, 1981

	Encumbered-Expended Jan. 1, 1946 to June 30, 1975	Scheduled July 1, 1975 to June 30, 1981
Water System		
Load Control Center	\$ 1,444,615.96	\$ 1,128,520
Torresdale Plant.....	27,995,216.77	5,132,600
Queen Lane Plant.....	14,146,183.96	15,927,840
Belmont Plant.....	13,721,996.08	5,142,600
Water Pumping Stations.....	15,312,937.73	4,240,080
Water Mains—Built, Replaced, Cleaned and Lined	108,798,435.69	39,636,320
Filtered Water Storage.....	14,570,826.91	19,101,920
Universal Metering.....	4,788,064.00	—
Miscellaneous.....	9,631,857.71	3,689,080
High Pressure Fire System.....	5,776,466.78	1,578,040
Totals.....	<u>\$216,186,601.59</u>	<u>\$95,577,000</u>

	Encumbered-Expended Jan. 1, 1946 to June 30, 1975	Scheduled July 1, 1975 to June 30, 1981
Wastewater System		
Northeast Water Pollution Control Plant	\$ 19,276,884.68	\$ 524,000
Southeast Water Pollution Control Plant	7,699,756.62	484,000
Southwest Water Pollution Control Plant.....	12,911,146.82	786,000
Wastewater Pumping Station.....	3,107,204.71	1,251,000
Interceptors.....	55,150,087.63	22,864,000
Sewers—Built & Replaced	217,772,403.16	69,165,940
Water Pollution Abatement Program.....	24,429,179.83	338,620,000
Miscellaneous.....	9,377,237.13	2,514,420
Storm & Flood Relief.....	33,190,955.24	24,966,640
Totals.....	<u>\$382,914,855.82</u>	<u>\$461,176,000</u>



20 Years of Better Teeth: Officials of the City Government and County Dental Society marked the 20th anniversary, September 19, 1974, of the start of water fluoridation in Philadelphia. Managing Director Hillel S. Levinson holds a token \$60 million check, for savings on dental bills realized by parents.



Abundant Water: Philadelphia had plenty of good water for every customer need. Water use within the city totaled 133 billion gallons annually. This water was one of America's purest finished waters.



SUMMARY OF CAPITAL ACTIVITY 1968-69 to 1974

	Fiscal Period ¹ 1968-69 \$	Fiscal Period 1970 \$	Fiscal Period 1971 \$	Fiscal Period 1972 \$	Fiscal Period 1973 \$	Fiscal Period 1974 \$
Capital Contracts Encumbered at Beginning of Period	19,720,719	31,209,172	25,654,314	17,933,474	21,826,121	16,066,859
Add: Capital Work Initiated	38,720,673	10,574,111	12,848,928 ²	23,017,772	17,350,441	24,641,258
Total: Net Capital Activity	58,441,392	41,783,283	38,503,242	40,951,246	39,176,562	40,708,117
Less: Capital Expenditures	27,232,220	16,128,969	20,569,768	19,125,125	23,109,703	16,358,172
Capital Contracts Encumbered at End of Period.....	<u>31,209,172</u>	<u>25,654,314</u>	<u>17,933,474</u>	<u>21,826,121</u>	<u>16,066,859</u>	<u>24,349,945</u>

1. 18 months transition period, ended June 30, 1969.

2. Revised from previous report by elimination of two projects totaling \$8,672,000 not in fact initiated.

CAPITAL ACTIVITY—1975

	Water \$	Sewer \$	Storm & Flood Relief	Total \$
Capital Contracts Encumbered July 1, 1974.....	5,657,603	18,692,342	—	24,349,945
Add: Capital Contracts Initiated in Fiscal 1975	7,625,955	27,653,648	—	35,278,603
Total: Net Capital Activity in 1975.....	13,282,558	46,345,990	—	59,628,548
Less: Capital Expenditures in 1975.....	8,784,541	17,349,276	—	26,133,817
Capital Contracts still Encumbered June 30, 1975.	<u>4,498,017</u>	<u>28,996,714</u>	—	<u>33,494,731</u>



WATER AND SEWER FUNDS

Pages 49-52

COMPARATIVE CONSOLIDATED BALANCE SHEET—ACCRUAL BASIS JUNE 30, 1975 AND 1974 [Note 1]

Assets and Other Debits	Fiscal 1975		Consolidated	
	Water	Sewer	Fiscal 1975	Fiscal 1974
Utility Plant				
Utility Plant in Service (Note 2).....	\$326,168,567	\$457,010,677	\$783,179,245	\$762,937,364
Construction Work in Progress.....	9,642,501	15,715,382	25,357,884	19,646,371
Unexpended Construction Authorizations (Note 3).....	12,278,766	57,880,183	70,158,949	85,217,965
Total Utility Plant	<u>\$348,089,835</u>	<u>\$530,606,243</u>	<u>\$878,696,079</u>	<u>\$867,801,700</u>
Current Assets				
Cash.....	\$ 9,283,148	\$ 12,549,369	\$ 21,832,518	\$ 31,828,126
Accounts Receivable:				
Customers, for Utility Service (Note 4A).....	9,592,429	10,097,021	19,689,450	17,476,181
Others.....	534,700	417,207	951,907	895,836
Estimated Uncollectible Receivables (Note 4B).....	(3,495,230)	(3,591,478)	(7,086,708)	(5,898,686)
Due from Other Municipal Funds.....	2,450,101	4,262,521	6,712,622	596,545
Materials and Supplies at Cost.....	2,753,352	547,912	3,301,265	2,757,800
Prepaid Expenses.....	250,748	35,152	285,900	26,813
Total Current Assets	<u>\$ 21,369,250</u>	<u>\$ 24,317,706</u>	<u>\$ 45,686,957</u>	<u>\$ 47,682,615</u>
Restricted—Cash Held in Sinking Fund Reserve (Note 5).....	\$ 1,363,671	\$ 4,426,042	\$ 5,789,713	\$ 5,789,713
Total Assets and Other Debits	<u>\$370,822,757</u>	<u>\$559,349,991</u>	<u>\$930,172,749</u>	<u>\$921,274,028</u>
Liabilities and Other Credits				
Long-Term Debt and Other Credits				
General Obligation Bonds Payable.....	\$ 97,119,289	\$164,930,309	\$262,049,598	\$287,285,141
General Obligation Bonds Sinking Fund Assets	(559,559)	(1,316,963)	(1,876,523)	(11,741,928)
Revenue Bonds Payable	17,665,000	57,335,000	75,000,000	75,000,000
General Obligation Bond Authorizations Unissued.....	15,000,000	37,200,000	52,200,000	52,200,000
Total Long-Term Commitments	<u>\$129,224,729</u>	<u>\$258,148,345</u>	<u>\$387,373,074</u>	<u>\$402,743,213</u>
Excess of Utility Plant and Fund Accounts				
Over Long-Term Bond Commitments	218,865,106	272,457,898	491,323,005	465,058,487
Total Long-Term Debt and Other Credits	<u>\$348,089,835</u>	<u>\$530,606,243</u>	<u>\$878,696,079</u>	<u>\$867,801,700</u>
Current Liabilities				
Accounts Payable	\$ 2,757,025	\$ 684,615	\$ 3,441,641	\$ 1,795,370
Accrued Payroll	333,326	153,951	487,278	394,736
Due to Other Municipal Funds	313,548	990,811	1,304,360	2,160,453
Provisions for Indemnities	34,348	10,125	44,473	43,578
Monies Held in Escrow	—	—	—	557,525
Total Current Liabilities	<u>\$ 3,438,249</u>	<u>\$ 1,839,503</u>	<u>\$ 5,277,753</u>	<u>\$ 4,951,662</u>
Surplus and Surplus Reserves				
Reserve for Commitments.....	\$ 1,975,614	\$ 3,088,785	\$ 5,064,400	\$ 5,115,887
Sinking Fund Reserve—Provided from First Series Bond				
Proceeds (Note 5)	1,363,671	4,426,042	5,789,713	5,789,713
Surplus:				
Invested in Materials and Supplies	2,753,352	547,912	3,301,265	2,757,800
Estimated Collectible Receivables.....	6,631,898	6,922,750	13,554,649	12,473,331
Unencumbered Funds Available for Appropriation	6,552,911	11,902,652	18,455,564	22,357,122
Other Net Non-Cash Assets.....	17,223	16,100	33,324	26,813
Total Surplus.....	<u>\$ 15,955,387</u>	<u>\$ 19,389,416</u>	<u>\$ 35,344,803</u>	<u>\$ 37,615,066</u>
Total Surplus and Surplus Reserves	<u>\$ 19,294,672</u>	<u>\$ 26,904,244</u>	<u>\$ 46,198,917</u>	<u>\$ 48,520,666</u>
Total Current Liabilities, Reserves and Surplus	<u>\$ 22,732,921</u>	<u>\$ 28,743,748</u>	<u>\$ 51,476,670</u>	<u>\$ 53,472,328</u>
Total Liabilities, Surplus and Other Credits.....	<u>\$370,822,757</u>	<u>\$559,349,991</u>	<u>\$930,172,749</u>	<u>\$921,274,028</u>

For notes to this table see foot of page 50.

**COMPARATIVE CONSOLIDATED ANALYSIS OF CHANGES IN FUND
BALANCE AND FUND BALANCE RESERVES—ACCRUAL BASIS
FOR THE FISCAL YEARS ENDED JUNE 30, 1975 AND 1974 [Note 1]**

	Fiscal 1975		Consolidated	
	Water	Sewer	Fiscal 1975	Fiscal 1974
Balance—Surplus and Surplus Reserves.....	\$21,883,894	\$26,636,771	\$48,520,665	\$44,253,554
Add (Deduct) Adjustments to Beginning Balance:				
Appropriated to Current Fiscal Year—(Note 2).....	\$ (2,895,489)	\$ (6,703,000)	\$ (9,598,489)	\$ (1,559,439)
Actual Revenues Minus Estimated Revenue	1,549,692	5,114,209	6,663,901	1,563,230
Adjustments to Prior Year Billings.....	(204,296)	358,098	153,802	(882,734)
Reversal of Accrued Expenses and Vouchers in Transit.....	461,886	290,223	752,119	779,234
Reverse 1974 Increase in Provision for Uncollectibles.....	715,000	899,277	1,614,227	1,645,933
Additional Commitments Charged to Surplus (Net).....	(12,399)	(10,226)	(22,625)	(19,516)
Adjustment to Prior Year Materials Inventory.....	—	—	—	(107,533)
Unrecorded Charges Against Prior Years' Revenues Received.....	—	—	—	(94,605)
Other (Charges) or Credits—Net.....	255,370	457,384	712,754	(1,572,438)
Net Adjustment to Prior Year Balance.....	\$ (130,235)	\$ 405,976	\$ 275,741	\$ (247,868)
Adjusted Prior Year Ending Balance	\$21,753,658	\$27,042,747	\$48,796,406	\$44,005,686
Sinking Fund Reserve—Revenue Bonds.....	—	—	—	5,789,713
Net Gain or (Loss) Fiscal Year Ended June 30.....	(2,458,986)	(138,503)	(2,597,489)	(1,274,733)
Balance—Surplus and Surplus Reserves, June 30.....	<u>\$19,294,672</u>	<u>\$26,904,244</u>	<u>\$46,198,917</u>	<u>\$48,520,666</u>

NOTES:

1. A municipally owned and operated Water and Sewer Utility has certain unique characteristics. Accordingly this statement is to be read only in conjunction with the Summary of Significant Accounting Policies shown on page 52.
2. The Water Fund appropriation included \$3,320,511 for expenses

attributable to the Sewer Fund in Fiscal 1975 and \$2,984,561 in Fiscal 1974. The Sewer Fund receives an appropriation to reimburse the Water Fund. Both the initial Water Fund expense and reimbursement received therefore have been eliminated in the Water Fund on the Accrual Basis statement.

Figures may not add due to rounding and eliminations.

Notes to Comparative Consolidated Balance Sheet Shown on Page 49

NOTES:

1. A municipally owned and operated Water and Sewer Utility has certain unique characteristics. Accordingly, this statement is to be read only in conjunction with the Summary of Significant Accounting Policies shown on page 52.
2. Utility Plant in Service. The valuation of plant acquired prior to January 1, 1958 was based on a physical inventory as of December 31, 1957, made by the Procurement Department, which is charged with this responsibility under the Philadelphia Home Rule Charter. Real property was valued herein at actual cost, where such cost was ascertainable, or engineering estimates where actual cost was not ascertainable. Equipment defined as personal property under the City's object classification procedures was valued at cost or replacement value fixed by the Procurement Department as adjusted for the condition of the property. Assets acquired subsequent to December 31, 1957 are recorded in perpetual inventory records and are stated at actual cost. All fixed assets, from whatever source acquired or financed, are included in the valuation.

3. Includes encumbered amounts in the City's Capital Projects Fund and amounts in the City's Consolidated Bond Fund which are earmarked for Water Department construction purposes.

4. The material aspects of these balances are:

(A) \$8,789,234 billed 1/1/75 to 6/30/75; \$8,775,877 billed in 15 year cycle billing periods 1/1/60 to 12/31/74; \$2,124,339 of penalties on receivables at 6/30/75.

(B) \$938,804 of billings 1/1/75 to 6/30/75; \$4,413,164 billed in 15 year cycle billing periods 1/1/60 to 12/31/74; \$1,343,988 of penalties on receivables at 6/30/75; miscellaneous receivables \$390,753.

(Of the total billings to customers for utility service during the period 1/1/60 to 6/30/75 of \$655,994,469, the aggregate estimated uncollectible receivables of \$7,086,709 over the same period is 1%.)

5. This amount is on deposit at the Philadelphia National Bank in Account Number 196-3618. The City Treasurer is the only authorized signer for this account.

Figures may not add due to rounding and eliminations.

**COMPARATIVE CONSOLIDATED STATEMENT OF INCOME, EXPENSES AND SURPLUS
FOR THE FISCAL YEARS ENDED JUNE 30, 1975 AND 1974 (Note 1)**

	Fiscal 1975		Consolidated	
	Water	Sewer	Fiscal 1975	Fiscal 1974
Operating and Other Revenues				
Metered Sales	\$28,542,316	\$27,432,533	\$55,974,849	\$55,779,928
City and Other Municipal Sales.....	1,196,450	2,310,506	3,506,956	3,266,339
Public Fire Protection.....	1,206,887	—	1,206,887	1,388,465
Private Fire Connection.....	455,345	—	455,345	559,574
Industrial Sewage Surcharge.....	—	936,004	936,004	1,143,625
Other Operating Revenue.....	975,918	805,488	1,781,407	1,745,819
Miscellaneous Income.....	1,444,875	4,406,356	5,851,232	4,601,113
Total Operating and Other Revenues.....	\$33,821,793	\$35,890,889	\$69,712,682	\$68,484,863
Operating Revenue Deductions				
Operating Expenses, Other than Maintenance (Note 2)	\$17,114,203	\$10,605,363	\$27,719,567	\$26,105,328
Maintenance Expenses	6,655,523	3,535,120	10,190,643	9,833,417
Total Operating Expenses.....	\$23,769,726	\$14,140,484	\$37,910,210	\$35,938,745
Replacement of Equipment				
Replacements and Additions of Equipment—				
Operating Funds	\$ 853,735	\$ 701,787	\$ 1,555,523	\$ 1,135,171
Net Operating Expenses	\$24,623,461	\$14,842,271	\$39,465,733	\$37,073,916
Net Operating and Other Revenues	\$ 9,198,331	\$21,048,618	\$30,246,949	\$31,410,947
Revenue Bond Debt Service				
Interest on First Series Bonds	\$ 878,538	\$ 2,851,459	\$ 3,729,998	\$ —
Interest on First Series Charged to Construction (Note 3)	(878,538)	(2,851,459)	(3,729,998)	—
Net Revenue Bond Debt Service	\$ —	\$ —	\$ —	\$ —
General Obligation Bond Debt Service				
Interest on Long-Term General Obligation Debt	\$ 4,224,926	\$ 7,097,709	\$11,342,635	\$11,647,434
Amortization of Bonded General Obligation Debt.....	5,474,475	9,488,901	14,963,376	14,982,463
Total General Obligation Bond Debt Service.....	\$ 9,719,401	\$16,586,610	\$26,306,011	\$26,629,897
Total Debt Service Deductions.....	\$ 9,719,401	\$16,586,610	\$26,306,011	\$26,629,897
Other Deductions				
Interest on Advances from Capital Projects Fund.....	\$ 8,915	\$ —	\$ 8,915	\$ 2,000,709
Interdepartmental Charges	1,929,000	4,600,511	6,529,511	4,055,074
Total Deductions from Net Operating and Other Revenues.....	\$11,657,317	\$21,187,121	\$32,844,438	\$32,685,680
Net Loss for the Year	\$ (2,458,986)	\$ (138,503)	\$ (2,597,489)	\$ (1,274,733)
Surplus and Surplus Reserves at the Beginning of the Year...	21,883,894	26,636,771	48,520,665	44,253,554
Sinking Fund Reserve—Contributed by Bond Fund (Note 4) ..	—	—	—	5,789,713
Other Adjustments to Surplus (Net).....	(130,235)	405,976	275,741	(247,868)
Total Surplus and Surplus Reserves at the End of the Year.....	\$19,294,672	\$26,904,244	\$46,198,917	\$48,520,666

NOTES:

1. A municipally owned and operated water and sewer utility has certain unique characteristics. Accordingly this statement is to be read only in conjunction with the Summary of Significant Accounting Policies shown on page 52.
2. Includes adjustment for increase in estimated uncollectible accounts receivable in the amount of \$1,188,022. (In Fiscal 1974 this was \$1,614,278). Also includes payments in lieu of taxes of \$1,185,000 for each Fiscal Year.
3. During Fiscal 1975 the Water Department adopted the practice of charging long term debt interest during construction to project cost. This practice is consistent with recommendations of the National Association of Regulatory Utilities Commissioners and generally accepted accounting principles for water and sewer utilities.
4. This amount is on deposit at the Philadelphia National Bank in Account Number (196-3618). The City Treasurer is the only authorized signer for this account.

Figures may not add due to rounding and eliminations.

**CONSOLIDATED RECONCILIATION OF UNENCUMBERED FUNDS
AVAILABLE FOR APPROPRIATION TO SURPLUS AND SURPLUS RESERVES
AS SHOWN ON BALANCE SHEET—ACCRUAL BASIS (Note 1)**

	Fiscal Years Ending June 30	
	1975	1974
Unencumbered Funds Available for		
Appropriation (Note 2).....	\$18,455,564	\$22,357,122
Other Surplus and Surplus Reserves		
Reserve for Commitments.....	5,064,400	5,115,887
Sinking Fund Reserve.....	5,789,713	5,789,713
Invested in Materials and Supplies.....	3,301,266	2,757,800
Estimated Collectible Receivables.....	13,554,650	12,473,331
Other Net Non-Cash Assets.....	33,324	26,813
Total Surplus and Surplus Reserves (Note 3).....	<u>\$46,198,917</u>	<u>\$48,520,666</u>

NOTES:

1. A municipally owned and operated Water and Sewer Utility has certain unique characteristics. Accordingly this statement is to be read only in conjunction with the Summary of Significant Accounting Policies shown on page 52.
2. This is determined on a Modified Accrual Basis of Accounting as shown in the financial statements and accounts of the City audited by the City Controller.
3. As shown on the Consolidated Accrual Basis Balance Sheet.

**CONSOLIDATED WATER AND SEWER SYSTEMS
SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES**

A. Basic Principles of Governmental Accounting and Reporting Applicable to the Water and Sewer Systems.

Legal Compliance and Financial Operations

1. A governmental accounting system must make it possible: (a) to show that all applicable legal provisions have been complied with; and (b) to determine fairly and with full disclosure the financial position and results of financial operations of the constituent funds and self-balancing account groups of the governmental unit.

Conflicts between Accounting Principles and Legal Provisions

2. If there is a conflict between legal provisions and generally accepted accounting principles applicable to governmental units, legal provisions must take precedence. Insofar as possible, however, the governmental accounting system should make possible the full disclosure and fair presentation of financial position and operating results in accordance with generally accepted principles of accounting applicable to governmental units.

The Budget and Budgetary Accounting

3. An annual budget should be adopted by every governmental unit, whether required by law or not, and the accounting system should provide budgetary control over general governmental revenues and expenditures.

Fund Accounting

4. Governmental accounting systems should be organized and operated on a fund basis. A fund is defined as an independent fiscal and accounting entity with a self-balancing set of accounts recording cash and/or other resources together with all related liabilities, obligations, reserves, and equities which are segregated for the purpose of carrying on specific activities or attaining certain objectives in accordance with special regulations, restrictions, or limitations.

Depreciation

5. Depreciation on general fixed assets should not be recorded in the general accounting records. Depreciation charges on such assets may be computed for unit cost purposes, provided charges are recorded only in memorandum form and do not appear in the fund accounts.

Basis of Accounting

6. For operating funds, the modified accrual basis of accounting is prescribed and is defined as that method of accounting under which with minor exceptions revenues are on a cash basis and obligations are on an accrual basis.

Conservatism

7. Frequently, assets are measured in a context of significant uncertainties. Historically, managers, investors, and accountants have generally preferred that possible errors in measurement be in the direction of understatement rather than overstatement of net income and net assets. This has led to the accounting convention of Conservatism which is expressed in the rules adopted by the profession.

Proper valuation of trade accounts receivable is a most important area where the accounting convention of conservatism is applicable.

Proper valuation of inventories is another important application of the convention of conservatism.

B. In the Water and Sewer Systems these principles are applied as follows. (Paragraph numbers are keyed to the basic accounting principle in A. above.)

1. The Financial Statements prepared by the Office of the Director of Finance show compliance with the Budget Ordinance(s) as adopted by City Council. These statements are prepared from books of account which are maintained on a Modified Accrual Basis of Accounting. In the budgets, the Water and Sewer Funds are identified as operating funds and not as enterprise funds.

Accordingly, the general books of account and the Financial Statements of the Director of Finance are on a Modified Accrual Basis of Accounting.

2. The conflict between the legal requirement to account for the Water and Sewer Funds as operating funds and the accounting principles requirement to treat these Funds as enterprise funds is resolved to the extent practicable by the records and supplementary financial statements prepared by the Water Department.

The Water Department accounting records are maintained, to the extent practicable, on the Accrual Basis of Accounting.

The attached financial statements are the consolidation of the end product of the Water Department's financial accounting process.

3. Each year an Operating Budget Ordinance is adopted by City Council for the Water and Sewer Funds as required by the Philadelphia Home Rule Charter.

4. The Water Fund and the Sewer Fund are each organized and operated on a Fund basis. Each fund has its own self-balancing group of accounts.

5. The present self-balancing system of accounts for real (Balance Sheet) accounts does not provide for an accumulation of the charges of depreciation. Accordingly, allowance for depreciation is not shown on the Water and Sewer System accrual basis balance sheets.

When Utility Plant in Service is replaced, the cost of replacement is added to the Utility Plant in Service Accounts. Simultaneously the plant records are relieved of an amount to recognize the retirement of the asset which has been replaced. Engineering indices are used to derive the estimated original cost of that specific asset or segment of the system which is to be retired.

6. In the audited accounts of the City, the Water and Sewer Funds are operating funds. To the extent practicable the Accrual Basis of Accounting is followed in the Water Department's system of accounts. The attached financial statements have been prepared to the extent practicable on this basis and reconciled to the audited accounts.

7. The Water Department's financial statements present accounts receivable and inventories most conservatively:

(a) The net collectible accounts receivable are fully reserved and thus are not included in unencumbered funds available for appropriation.

(b) Materials and supplies inventories are valued at a standard cost which is no greater than original cost. The inventory value is fully reserved and thus is not included in unencumbered funds available for appropriation.

The amounts shown in the attached consolidated statements have been reconciled to the Modified Accrual Basis as used in the general books of account of the City of Philadelphia.





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